THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CVIII. No. 2431.] LONDON, DECEMBER 14, 1909. [61ST YEAR. PRICE 6d.

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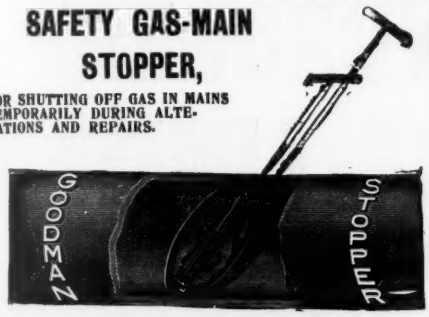

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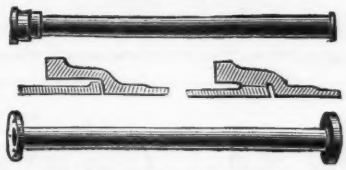

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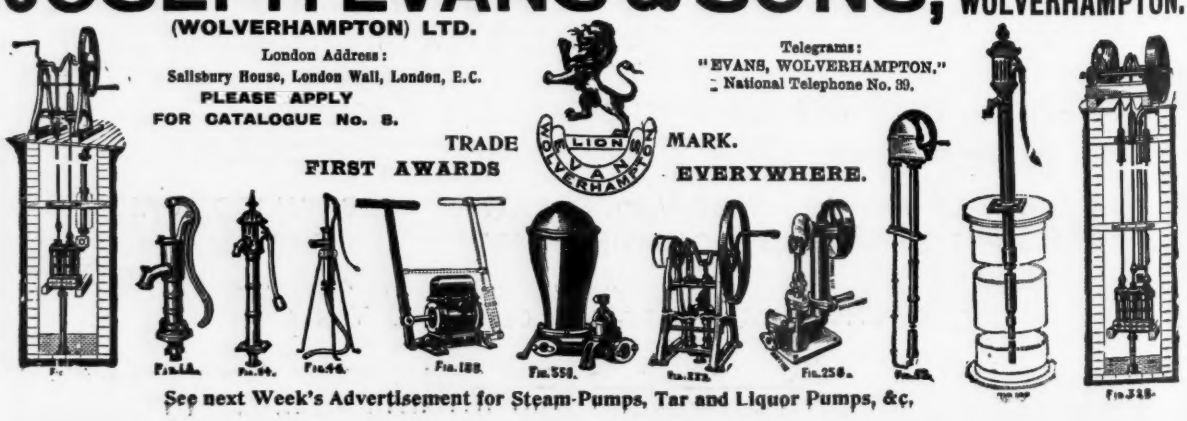

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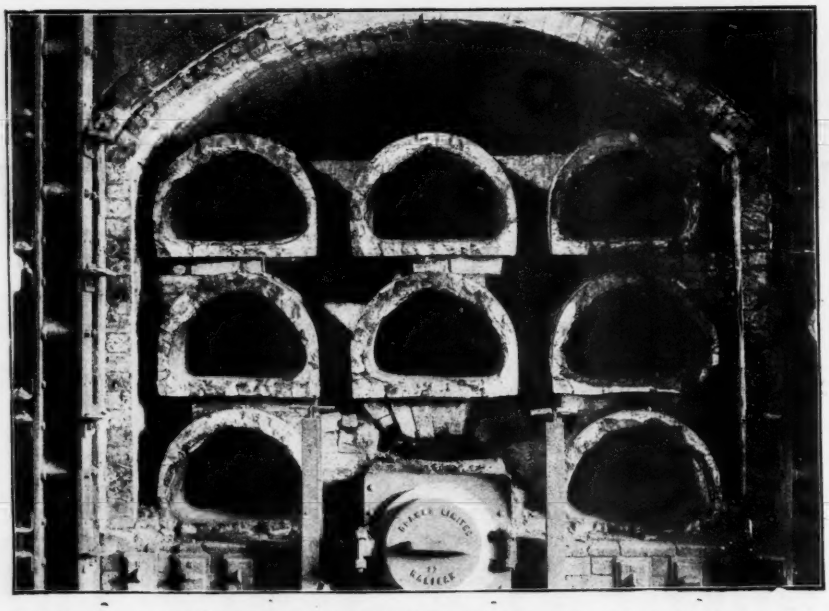

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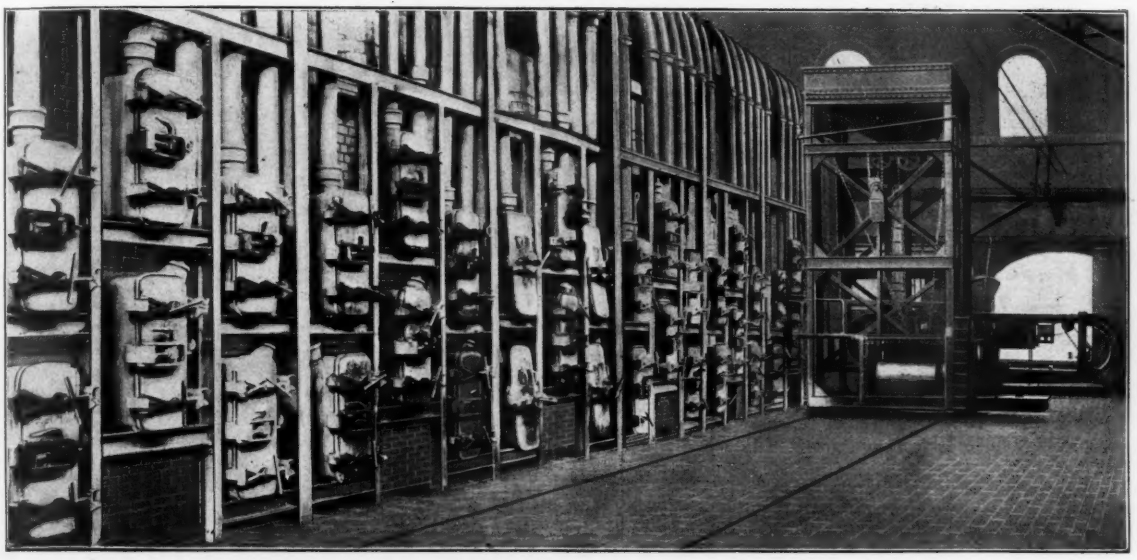

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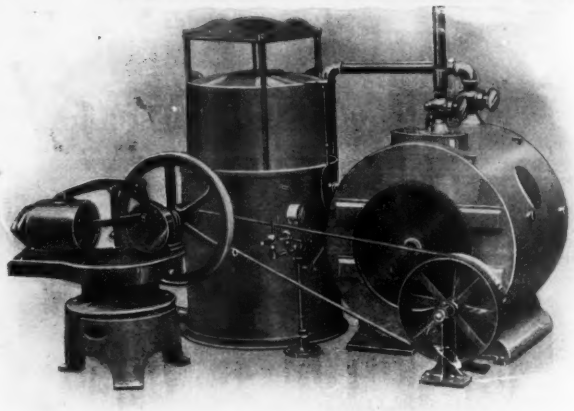

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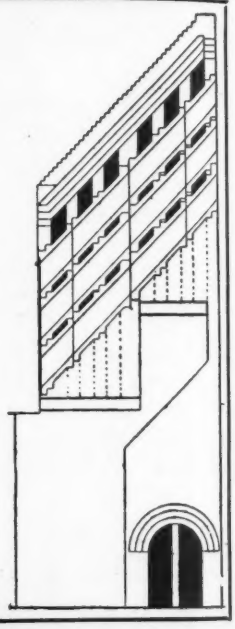

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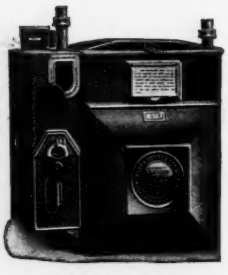

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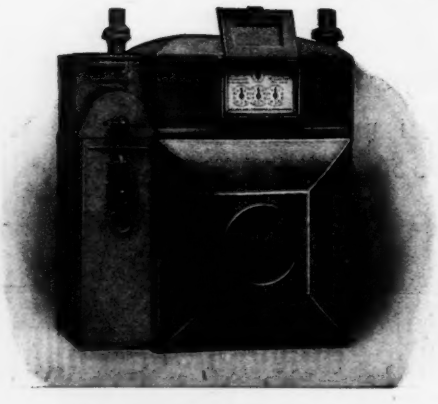

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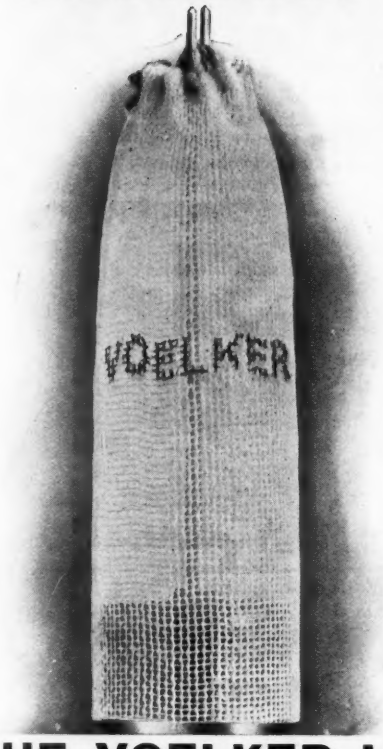

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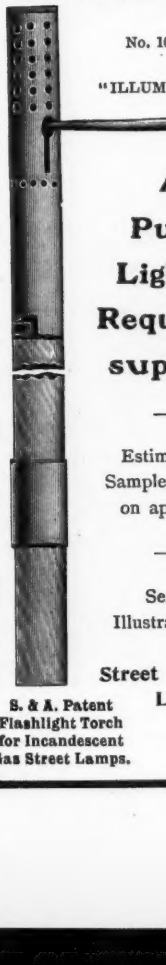

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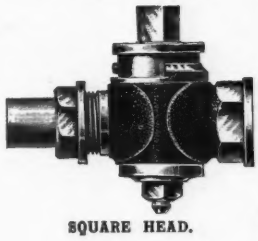

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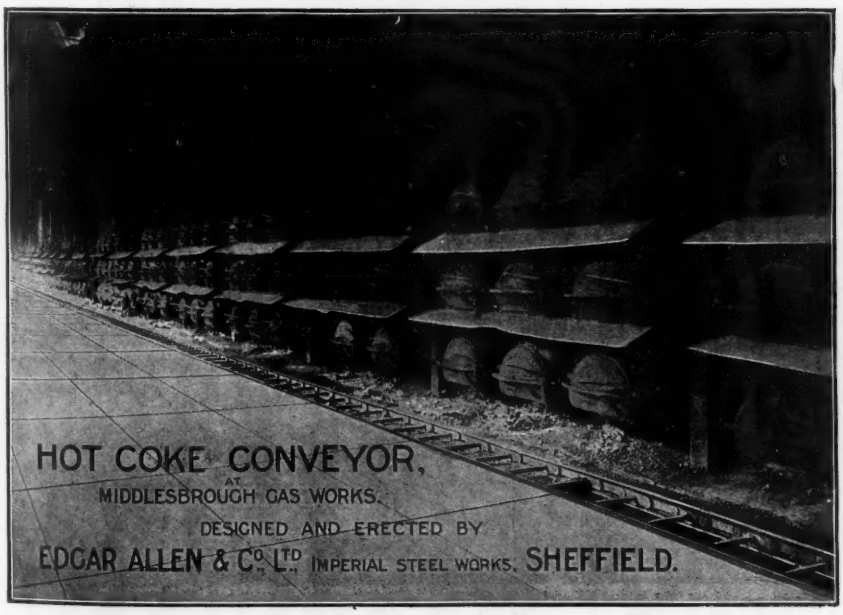
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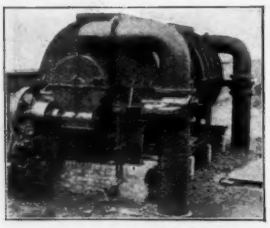
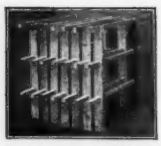


WASHER-SCRUBBER,



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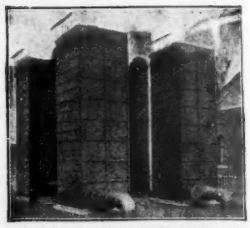

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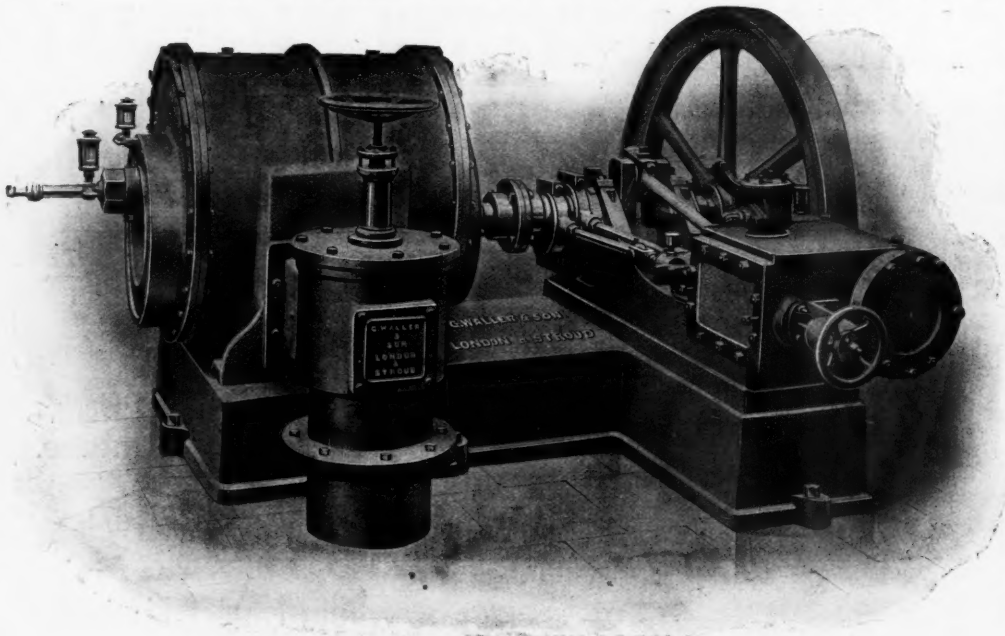

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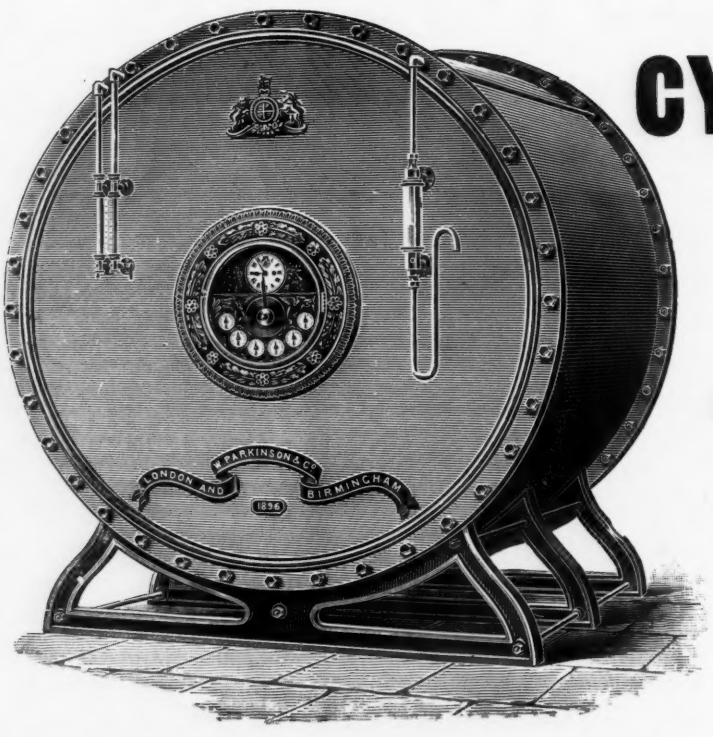

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VOL. CVIII., No. 2431.—TUESDAY, DECEMBER 14, 1909.

EDITORIAL NOTES—GAS, &c.

A Terrible Disaster.

UNPARALLELED in the history of gas manufacture, a catastrophe has occurred at the Grasbrook Gas-Works of the City of Hamburg which has, we venture to think, aroused the sympathies of gas engineers the world over with their professional colleagues of Hamburg, and with the stricken families of the men and women who met with their death by being crushed or burned. With characteristic thoughtfulness, the President of the Institution of Gas Engineers, Mr. James W. Helps, immediately the dire nature of the calamity became known to him, telegraphed (and afterwards supplemented the message by a letter), in the name of the British gas profession, an expression of profound sympathy with the city and all who were suffering in any way from the appalling misfortune. Certainly close upon fifty lives have been lost—thirty are known, some sixteen, it was estimated a few days ago, lie buried beneath the wreckage of the huge gasholder that was the seat of the catastrophe, and, in addition, there are some forty to fifty severely injured persons. A great amount of valuable property—representing the expenditure, much of it recent, of many thousands of pounds—has been destroyed, or rendered practically useless. The threads of the terrible story have been gathered together by us as completely as is possible at the present time; but the real cause of the disaster—the point round which technical interest will accumulate on reading the story—has yet to be determined, if it be possible to determine it now from evidence of workmen who were at the time distracted with fright, and from such testimony as the wreckage will reveal.

A gasholder—the largest of its type in the world, not, as our readers are aware, the largest gasholder in the world, as the daily papers have persisted in calling it—with its annular tank mounted on a concrete and masonry substructure, forming a store and canteen, and permitting of goods trains traversing underneath, was the seat of the disaster. The holder has a capacity of 7,060,000 cubic feet, has a diameter of about 250 feet, and rises 200 feet high. The contract price for the holder was about £50,000; and it has only been taken over from the contractors within the past few weeks. Only two facts are definite regarding the origin of the disaster. The one is that from this holder gas suddenly escaped in huge volumes; and the other, that the gas became fired. Seemingly there was not much, if anything, in the nature of an explosion; but the 3 to 4 million cubic feet of gas that there were in the holder at the time, escaping, formed huge sheets of flame, and set fire to anything and everything that was combustible in the neighbourhood, and to what was not combustible the fearful heat appears to have brought an at present unestimated amount of destruction—involving not only the new holder, but most of the property in its vicinity. This included an old gasholder house, in which was a holder containing 1,400,000 cubic feet of gas, which gas, on being liberated by the damage occasioned by the collapse of the holder house roof, was consumed, in one large, magnificent, roaring flame in a space of time measured by a few transient seconds. Never has such an accident occurred on a gas-works before; never has so much town gas been consumed in such huge volumes before. Eye-witnesses describe the spectacle as grand but terrible; the waste of life and property was more terrible still.

To return to the huge gasholder, with its store, canteen, and railway lines beneath the tank. All the evidence of spectators, actual or pseudo, as to the origin of the disaster is, as is usually the case in all big catastrophes, conflicting; and nothing can be educed from the evidence that will at present allow any responsible person to speak with certainty as to the place from which the gas primarily escaped, and what untoward happening produced the escape. We must wait for the official inquiry and report on the matter to see whether the technical ability that will be brought to bear in the attempt to discover the cause will be in any degree successful in getting beyond surmise. We sincerely hope it will be, if only to enable precautions to be taken against recurrence. It is also only right to suspend judgment on all points that are not obvious, in view of the reputations of the engineers and contractors concerned in the erection of the holder. One thing is perfectly obvious from the reports before us; and it is that the catastrophe has proved that the open store beneath the tank is a source of weakness, in the shape of danger, in the construction of the holder. Whether the gas commenced to escape from a blown cup, and was swept underneath into the store, where it found brief harbourage, or whether the gas found entrance into the store through a gradually developed crack in the upper part, it is clear it was from the arches surrounding the store that huge waves of flames passed, which were maintained by gas—from where? One can only suppose from the roof of the store through openings produced by the intense heat, or some prior cause. Certain it is, too, that in this store there is a big wreckage of masonry and iron work; and beneath that lives have been lost. Through the long years of gas supply, never has a holder with sunk tank or tank on the ground level produced such a disastrous record as has this new Grasbrook one. The form of its construction, with raised tank, has never recommended itself to British gas engineers, though as Mr. F. S. Cripps pointed out in the "JOURNAL" in 1901, an English invention anticipated by many years the German for the utilization as a store of the space beneath a gasholder tank; and it may be fairly positively stated that, now more than ever—whether or not the store of the Hamburg holder had part in the origin of the disaster, still it is known to have had part in the subsequent effects—there will be no disposition here to give the principle such favourable consideration as would lead to adoption. The cost of such a structure, too, must be considerable, far more than is justified by storage for material only; and the running of railway trains underneath such a structure requires more than economy of space to vindicate it. If pressure of space be the only support for adopting such a form of construction, British gas engineers would prefer the holder being built elsewhere. But these considerations are for the moment beside the main question, which is the cause of the Hamburg disaster. For this information, if it is ever discovered, there will probably have to be a little patience.

The Story of the Board of Trade Statistics.

THERE must be hearty congratulations to the department of the Board of Trade responsible for the preparation and issue of the returns relating to gas undertakings. It was only in June that we were dealing with the returns for the year 1907, referring to Gas Companies and to Local Authorities for the financial year ending March, 1908. Within six months, there are before us the returns relating to the Companies for 1908, and to Local Authorities for the year ending March, 1909. This latest issue excels previous performance, and is therefore a record. Having in view the mass of statistical collection, arrangement, and aggregation that the returns entail, it cannot be expected, nor will anyone be so unreasonable as to ask, that still greater speed shall be exercised. We do not want veracity sacrificed to undue speed. There are many who will be grateful for the unusual despatch shown on this occasion; and it is hoped—now it is seen what can be done—that the record will be maintained. The earlier the returns are issued, the greater their value. They are published on this occasion in time for use in the coming parliamentary session—a convenience that has been denied by the lateness of the returns in recent sessions—and will therefore be the more appreciated.

These returns are peculiarly interesting; but through a couple of errors that were made in the preceding ones, care

must be taken in collating the statistics. The total number of statutory undertakings included in the present returns is 790—an increase of nineteen, four of which are companies, and fifteen local authority concerns, some of the latter being only transfers from the former. The companies now number 499, and the local authorities 291. It is in taking the total figures at the end of the returns that care must be exercised in making comparison with the corresponding statistics in the previously issued ones. Taking the total figures of capital paid-up and borrowed, on comparison the £130,708,693 now shown represents the alarming increase of £16,843,643. But as was pointed out when the preceding returns were published, by some unaccountable reason—an oversight no doubt—the loan capital of the companies had been omitted from the total, which made a difference of £14,645,271 to the figure, which should have been £128,510,321, and not £113,865,050. If, therefore, we deduct the £14,645,271 from the £16,843,643, we have remaining as representing the actual increase in the capital paid-up and borrowed, £2,198,372, of which the companies are responsible for £1,474,543, the local authorities for £723,829. In several ways the local authorities appear to have been hardly hit during the year now under review. The total receipts of all undertakings amount to £30,519,639, which was an increase of £451,887, of which the companies took £445,823, leaving only £6064 for the local authorities. The expenditure for all the undertakings was £23,474,709; being an increase of £750,605, of which the companies were responsible for £590,951, and the local authorities for £159,654. But against the increased expenditure, the companies had available £445,823 of increased receipts, while the local authorities had only £6064. Again, if we turn to the quantity of gas sold, it is found that for all undertakings the quantity was 173,957,395,000 cubic feet, or an increase of 1,068,248,000 cubic feet. But inasmuch as the local authorities had an actual decrease in consumption in the year of 9,019,000 cubic feet compared with the preceding year, the companies take credit for a total advance of 1,077,267,000 cubic feet. The reason for the bad showing of the local authorities must be looked for principally, we fancy, in the depression in the manufacturing areas of Lancashire, Yorkshire, and parts of the Midlands. Still, taking the industry as a whole, progress was marked in business; and so, in view of the circumstances of the year, there is satisfaction.

Coming to the manufacturing figures, there is a cheering record. With an augmentation in the gas business, on a reduced consumption (taking the total figures) of 12,446 tons of coal, it is easy to trace manufacturing economies as expressed by an average increased production of gas per ton of coal. But for what there was in the way of an augmentation per ton, the local authorities have to take credit, though they have much to do yet to overtake the average production per ton of the companies. We are not going to attempt any explanation—it could at the best be but hypothetical—as to why the local authority undertakings are, on the average, so much in arrear of the companies in this regard, unless it be that so many of the local authority concerns are concentrated about the fields whence come the second-rate gas-making coals. However, the total coal consumption of the whole of the statutory undertakings was 15,394,307 tons—as said, a diminution of 12,446 tons. The companies exhibit an increase of 41,458 tons; and the local authorities a decrease of 53,904 tons. The figures as to gas made reflect the trend of carbonization effort. The total volume of gas produced was 189,918,737,000 cubic feet—or an increase of 1,432,044,000 cubic feet, though 12,446 tons of coal less were carbonized. Of this augmentation in make, the companies take credit for 1,285,404,000 cubic feet; the local authorities for 146,640,000 cubic feet, though the latter sold 9,019,000 cubic feet less than the year before.

Before treating of the question of make per ton, account has to be taken of the water gas made. The amount was 21,628,862,000 cubic feet, which is an increase of 1,368,979,000 cubic feet, of which the companies account for 1,305,259,000 cubic feet, and the local authorities for 63,720,000 cubic feet. Deducting the water-gas production, the companies made 103,429,223,000 cubic feet of gas from 9,281,738 tons of coal, which is equal to 11,143 cubic feet per ton. On the other hand, the local authorities made 64,860,653,000 cubic feet of gas, and used in doing so 6,112,569 tons of coal; the average make being 10,611 cubic feet per ton, or 532 cubic feet less than the companies. If the gas companies had only made the same quantity of gas per ton as the local authorities did, the 9,281,738 tons of coal the former carbonized would have yielded 4,937,884,616 cubic feet less than it did. On the other hand, the 11,143 cubic feet per ton of the companies is a falling off of 52 cubic feet per ton in comparison with the preceding year; and this 52 cubic feet per ton on 9,281,738 tons of coal carbonized by the companies represents no less than 482,650,376 cubic feet. The make of 10,611 cubic feet per ton of the local authorities is a gain on the year of 106 cubic feet; and the 106 cubic feet per ton on the 6,112,569 tons of coal carbonized at the local authorities works represent an aggregate improvement of 647,932,314 cubic feet. Be it remembered, too, the local authorities carbonized 53,904 tons less coal than the year before. These figures indicate in rather striking fashion the effect of comparatively small variations of make per ton on the totals of coal carbonized.

Though the local authorities had the diminution named in consumption, they—like the companies—had an expansion in the bases of business. The mains laid for all undertakings (34,490 miles) increased in the year by 954 miles, of which the companies claim 519 miles, and the local authorities 435 miles. The number of consumers, 5,916,120, is an increase of 250,944, of which the companies have connected up 168,200, and the local authorities 82,744. In the preceding returns, there was an error of 10,000 in the public lamps credited to the companies, whereby there appeared to have been an abnormal gain for one year. The figure for both companies and local authorities should have been 690,264; and this has been increased during the year to 700,696—the difference representing an addition of 10,432, of which 4964 have gone to the account of the companies, and 5468 to that of the local authorities. While there is regret at the decline in the gas consumption in the case of the local authorities concerns, in all other respects there is solid ground for ample satisfaction, bearing in mind the circumstances of the periods to which the statistics refer.

Leeds University Gas Lectures.

The Department of Fuel and Gas Engineering at the Leeds University, under the direction of Professor William A. Bone, D.Sc., F.R.S., have again made arrangements for courses of special gas lectures during next term, and which lectures, having regard to the synopses published elsewhere and the names of the responsible lecturers, we have every confidence in recommending to young gas engineers—especially those living in the North of England. We want an abundant success to attend these lectures, in order to give the Leeds University every possible encouragement. Those who are associated with the University, and are directly linked with the gas industry through the department, are keenly anxious that the work of the latter shall have the broadest possible base of utility for the industry. These lectures are one evidence of this, as they meet the requirements of young engineers engaged in gas-works whose circumstances will not permit them to devote the whole of their time to a period of University study. There are many assistants, juniors, and pupils in the gas industry to whom this will apply; and there are likewise many who will find that the fees for the course or courses of lectures are of such a moderate character that no one can call them prohibitive. Therefore, it is hoped that a good number will avail themselves of the opportunities for advanced study thus afforded. If the success of the courses last session may be taken as indicative of what will happen in the coming one, it may be predicted that a greater number of students will be enrolled, and that interest and value will be much enhanced. Last session the course of lectures was introduced. It was all new ground. Interest had to be aroused, and experience had to be gained. Nevertheless, no less than thirty-five students entered for the course of lectures by Dr. Harold G. Colman on "Gas "Manufacture" and by Mr. Walter Hole on "Gas Distribu- "tion," and forty for the course by Mr. Ernest Bury, M.Sc., on "Bye-Product Coking Processes."

It may be remembered that the course on gas manufacture by Dr. Colman last session began with the intention that it should be completed in fourteen lectures; but this was found impossible, and so there was an extension to sixteen. Profiting by the experience then gained, the course in the coming session has been further extended to twenty lectures, so that Dr. Colman may deal more thoroughly with those technical features of the subject that do not lie upon the surface of daily practices. The lectures will be compressed into ten weeks; and, as the information published elsewhere shows, very convenient arrangements have

been made for students residing at a distance from Leeds. Those within reasonable distance who desire to enlarge their scope of study to bye-product coking subjects can do so through the Saturday afternoon course of eight lectures by Mr. Bury, who will be remembered as having read a most enlightening paper at the Dublin meeting of the Institution. It will be observed that a course of lectures on the lines of those delivered by Mr. Hole last session has been omitted from the programme this session, as, looking forward, the intention is to have a more extended series of lectures on the subject in 1911. These arrangements will permit of both the manufacture and distribution subjects being more adequately treated than was possible in the first series of lectures. The synopsis of Dr. Colman's lectures calls for no comment; but attention may be directed to the final sentence: "Discussion of present-day requirements "for a public gas supply." Almost every phase of gas manufacture may be viewed from this particular platform; for the requirements of a gas supply to-day carry influences through—in fact, dominate—procedure from carbonization and the character of the evolved gas to delivery pressures. Both Dr. Bone and Dr. Colman have taken part in directing to the character of gas which carbonizing processes must be shaped to produce to best suit the needs of the day. But there is much work to be done in spreading comprehension of this matter; and the present lectures will be in part devoted to this work.

As to the future, we learn from Dr. Bone that arrangements are being made for special lectures—which will be taken in a series of courses spread over two or three years, and will deal with the different aspects of manufacture, distribution, and utilization of gas for lighting and heating purposes. It is probable, should there be the demand for them, that laboratory demonstrations will be arranged in connection therewith. It is the ambition of the Leeds University to make it the centre for the study of the science underlying gas practice, and to provide an opportunity for such study for as many as possible. We ask that a large measure of the support they now require for the perfecting of their schemes be accorded. The nature of that support may be described in one word—Students.

Misfortune—And After.

THE address that the new Chairman of the Continental Union Gas Company (Mr. J. H. Birchenough, C.M.G.) delivered to the proprietors last Tuesday reads almost like fiction; and yet it is all only too true. Never has a gas company been submerged so deeply in misfortune within the space of twelve months as has been this and the companion concern, the Union des Gaz. There has been the earthquake at Messina, the death in that tragic occurrence of the Company's Manager and many of the staff, the partial destruction of the works, the total cessation of business there, and uncertainty as to the future. The year through there have been labour ebullitions and outbursts at the Milan works. Within the past month, there has been the great strike of men at all the Italian stations. But the Directors and officials have, as all recognize, faced the cataclysm of misfortune with intrepid spirit; and though life and a certain amount of capital have been lost over Messina, and though treasure has been wasted through the costliness of the Italian strike, we do feel, and all our readers will feel who read the frankly-told tale of Mr. Birchenough, that there is a fair prospect of a new chapter now opening in the history of the Company that will be brighter than any that has preceded it. That, however, is the well-set hope. We will not here dwell on the Messina catastrophe. The Directors have already written off a considerable sum from the capital outlay represented there, by drawing upon the reserve and by asking the proprietors' consent—consent that was willingly accorded—to reduce the dividend from 6½ to 5 per cent. for the past year; and they are now making preparations for a full technical report upon the situation of the Messina concern. Upon this matter, as upon all others, Mr. Birchenough was most comprehensive and judicious in his statements and explanations.

Much as the proprietors knew of the extortionate proclivities of their Italian workmen, and of the moderation of the Directors and yet firmness in claiming those rights to which the Union des Gaz have title as employers and as responsible for the conduct of a *quasi*-public service, the proprietors were not a little astonished to hear the Chairman's recital of the recent demands of the men, which, if conceded, would have strangled the Company, and which, on being declined, brought about the strike, in which, happily, right throughout has prevailed over the inflated notions of the socialistic ultraists who were ever infusing their venom into the men, and over the violence by which the so-called leaders have sought to enforce their unreasonable demands. There is not a shadow of doubt—twenty-eight small strikes in eight months is a sufficient indication of the then prevalent unrest and ferment—that a trial of strength with the men was inevitable; and it was the men themselves who really gave the Company an opportunity for retrieving those elementary and essential rights to which they are entitled, but which had so long been denied them. In their hour of victory, the Directors and their executive officers have not claimed more than these. They have not desired to reduce wages or contract the privileges of the men in any way; but they have sought, and have obtained as the result of the men's own challenge, control of their own works and business, so as to fulfil their obligations in the best manner possible. They have, in short, gained by the costly strike one of the great essentials to the proper conduct of a business; and we shall be astonished if the men do not now see things in a somewhat new light.

Possibly, too, the workers will look with a little more graciousness on the proposal of the Board that there should be an economy-sharing scheme introduced. There is abundant scope for a project of the kind in these works—especially in those at Milan. Where stokers are only dealing with 2½ tons of coal per man per day, and where other men on the works "labour" (British, German, and French gas workers must forgive the expression) on a somewhat like scale, there is plenty of room for a profitable—profitable for Company and men—advance in efficiency. The men under the old order of things have shown no bashfulness in asking for as much as possible, nor any unwillingness in receiving as much as possible; but they have never offered anything in return. The more they have had, the more they have wanted; and the less they have been prepared to give. In future their progress in financial benefit may be in their own hands, by the simple process of recovering waste from inefficiency. We hope the men will be wise in this matter, though there is, looking into the records, some room for fear. Anyway they have courted the lesson they have received; and there is no question about the good that has been wrought. This, and the proposed introduction of a general law by the Government for the prevention of strikes and for compulsory arbitration, give better hopes of peace; but the laxity in Italy in the administration of the law will always cause one to speak of the prospects of peace in qualified terms. Genuine—aye, and heartfelt—were the encomiums poured by the Chairman at the meeting upon the leal and self-sacrificing work in these recent serious times of the executive officers and the attached workers of all grades; and the thanks were sincere to all who had contributed in any way to the upholding of right. The praise and the thanks were richly deserved.

A New Retort-House at Birmingham.

We must congratulate Mr. C. C. Barber on the paper he prepared for the Midland Junior Gas Engineering Association, and which was read last Saturday. It describes the design and construction of a retort-house at the Adderley Street works of the Birmingham Corporation, the Engineer-in-Chief of which (with Nechells) is Mr. Walter Chaney. It is in every respect a modern equipped house, with all accessories to economical working—such a house as one expects to find built in these days, when favour sides with horizontal retort working. There is always interest in reading such descriptive notices of new retort-houses of this kind, as in the detail one has an indication of the engineer's preferences, and of any special work necessitated by the character of the site. To pick out one of the difficulties peculiar to the site of this house, and which had its influence on the design of the constructional work pertaining to the building and the bench. At one end of the site, an old derelict gasholder tank, built in brick and puddle and 20 feet deep, was discovered; this on its abandonment having been filled with ashes and spent lime. On looking at the plan showing the foundations for the house and bench, it is apparent that this defect in the site must have caused an appreciable difference in the cost of the foundations, which at this part had to be carried to the tank bottom. In considering, therefore, the cost of the house, the additional expense that the extra work

occasioned must not be set against it, but against the economy of the filling-in in a time long since passed. Another interesting feature, illustrating the progress in carbonizing methods, is the productive value of the site in comparison with a former day. For three-quarters of its length the new house occupies the site of an old house that was tenanted by direct-fired and hand-charged settings. Under those conditions this part of the site only produced ¾ million cubic feet of gas. The new house is an extension on the old by one-fourth of the length of the latter; and this extension gives, under the new carbonization and working methods, a house capable of turning out 1¾ million cubic feet of gas per day. The economies of progress are illustrated here.

Power on Gas-Works.

In regard to the concluding part of Mr. Barber's paper, where it is shown how cheaply electricity for motive power can be generated by a private gas-engine-driven plant, for such a varying load as the requirements of a gas-works provide for the generating plant 0·35d. per unit for gas is an attractive figure. It would be of considerable interest if someone would, with an electricity plant such as that at Adderley Street, enter into the whole question of expense from the capital outlay to the running costs in comparison with other forms of power. The particulars collected should be of value not only for gas-works purposes, but, in a measure, as a guide in the competition for power business. Of course, for outside competition purposes, the figures would only have an approximate value, seeing that a retort-house electricity generating plant is running (practically continuously if the house is a large one) night and day, and that is not a condition that applies to many industries requiring power. On the other hand, the private generating plant in a factory does not incur the distribution expenses and losses that are a charge on the output of a central station. In this power question for gas-works, what with gas, steam, electricity, hydraulic power, and compressed air variously in service on them, there ought to be the material for much instructive research and communication either through our columns or in the form of a paper to one of the technical organizations. There are difficulties we know in the way of making such research, as the niceties of economy in respect of power are not studied on some gas-works as they are in other manufactories where fuel costs money, and is not, as is so frequently the case in a gas-works—at any rate, for boiler purposes—almost a waste product. In some works, too, situated by a river or having their own well, water is not an expensive item. Another difficulty in the way of thorough investigation is that in not many gas-works are there found provided the means for gauging power economy, and keeping control over it.

A Lecture on Photometry.

In almost as many weeks, the London and Southern District Junior Gas Association have had four fixtures—two of them being visits to works, one a paper, and the remaining one a lecture. The latter took place on Friday evening; and it says a good deal for the enthusiasm of the members that, in spite of these numerous Association engagements, they turned up in such satisfactory numbers. After all, however, it is perhaps not surprising, for the lecture was on an all-important subject, and by a gentleman who is able to speak with authority on the subject. The former was entitled "Light—And Some Reflections," and the latter was named Mr. Jacques Abady. From the full report of the lecture which appears (together with the subsequent discussion) in another part of to-day's number, it will be seen that Mr. Abady gave his audience a treat; and it may be added that they showed themselves thoroughly appreciative of the privilege that had been accorded to them. On the subject-matter of the lecture, we may possibly have something to say on a future occasion; but it can meanwhile be remarked that, as would have been expected, the question of photometry was dealt with in an intensely practical manner. Mr. Abady's text was the avoidance of empiricism; and he explained to the members that it was possible to carry out tests by means of a portable photometer without anything whatever that was empirical entering into the matter. With regard to some of the instruments which are at times used (and Mr. Abady said that those who advise these photometers are nearly all connected with the electrical industry), the lecturer gave his hearers some very plain truths; and altogether the members of the Association who were present spent a thoroughly enjoyable and at the same time, it may be said, a highly instructive evening.

The Growth of Officialism.

Some remarkable figures respecting the growth of officialism and the increase of its cost in a municipal borough conducted on quite moderate lines are published by a Torquay newspaper. Torquay is among the youngest of the boroughs; its Charter of Incorporation having been granted in 1892. In the year immediately following this important event in the history of the town, the municipal authority had in its service 26 officials, who were paid salaries amounting to a total of £2815 per annum. A few years later, there was an outcry to extend the boundaries of the borough; and the neighbouring districts of St. Mary Church, Babbacombe, and Cockington were added—the contention being, as is usual in such cases, that economy as well as efficiency would be promoted by governing the whole area from one common centre. How far these anticipations of better and cheaper service have been fulfilled, we are not told; but the amalgamation of the neighbouring local authorities with the borough has not had the effect of causing a reduction in the number of officials. On the contrary, instead of the 38 who were serving the Corporation in 1901-2, there are now 51; and the pay has risen from £4917 to £6760 per annum, with a promise of future increments which will bring the total to £6917. Thus the number of officials has practically doubled since the town was incorporated; and the salaries paid to them have grown by no less than 145 per cent. It is pointed out that these increases in number and pay are quite independent of the small army of school teachers who in the meantime have become municipal servants, and whose salaries are also advancing at a rapid rate. The experience of Torquay in the matter is not by any means unique; but the figures convey a lesson at a time when increasing efforts are being made to bring everything and everybody under bureaucratic rule.

The Eight-Hour Day in France.

An article in the current number of "Le Gaz" is devoted to a consideration of the possible consequences of the adoption of the eight-hour day in France, and particularly the effect on gas undertakings. The writer considers that the passing of such a law by the French Chambers would result in a rise in the price of the products of the industries with which gas-works are in touch; and, seeing that gas companies work under concessions which fix the charge to be made for gas, this would necessitate an advance in the price of residuals, which would in all likelihood not afford adequate compensation. Moreover, they have to keep up the supply of gas, and the additional labour required would probably cause an increase of 20 to 22 per cent. in the amount of wages paid over a year. This, it is thought, would give the death-blow to many works. Having stated the difficulties, the writer proceeds to consider the means of removing them. In his opinion, the only way of minimizing as far as possible the adverse pecuniary effect of the proposed law is to substitute piecework for wages, and, in conjunction with the change, to give premiums varying in value for the quantity of gas produced. At the same time he thinks that it would be advisable, wherever practicable, to replace labour by machinery.

Speculations to be Avoided.

In the "Journal" for July 13 last, under the head of "A Resuscitated Company: Men, Objects, and Promises," we dealt with the revival of one of Eaton's schemes, bearing the revised title of the Patent Block Tar, Motor Oil, and Asphalte Company, a concern which in its various guises has received attention at our hands from time to time. The prospectus issued in July, like its predecessor, fell on rocky ground; and there was precious little response to it in the way of hard cash—not sufficient, we should say, to pay the costs of issue, let alone the office expenses, and the compensation that was no doubt looked for to the owners of names that it was hoped would be magnetic—such as Sir C. B. H. Soame, Bart., H. W. L. Way, John Maclean, and S. J. Acland, "M.I.G.E." The hopes of Eaton in these men must have fallen low. But another effort is being made to secure more cash. Our estimate of the concern and of those who are trying to engineer it has not changed; and so our advice is to give it a very wide berth. In the process there is no 150 or any other percentage of dividend worth having by investors; and if the public are foolish enough to part with their money, it will be found that the concern will go precisely the way of others that have come from the same hatching-place. The other group of promoters are now also busy trying to scrape in money in connection with the Bude Gas

Company and the South Lincolnshire Water Company. The Directors of the latter Company are, though the prospectus is dated Dec. 6, offering six months' interest at the rate of 5 per cent. per annum to be paid to purchasers on Dec. 31. The temptation is not so potent as it used to be. It is now familiar to investors. However, the public do not show much confidence in these concerns; and we are not sorry.

Natural Gas in Western Canada.—A Canadian correspondent writes to "The Times" as follows: "Few are aware that in Southern Alberta a vast underground supply of natural gas has been tapped, and is being turned to great advantage by the people. At Medicine Hat, where the Crow's Nest branch to Lethbridge and beyond leaves the main line of the Canadian Pacific Railway, the city owns three wells, about 1000 feet deep, two producing about 1 million cubic feet of gas, and the third 3 million cubic feet daily. The Canadian Pacific Railway Company has its own well, with a daily output of 1,225,000 cubic feet. At Dunsmore, in the same neighbourhood, there is a well, 1285 feet deep, producing 1,600,000 cubic feet of gas a day; and at Suffield a well 1180 feet deep has a daily output of 65,000 cubic feet. Near the city of Calgary, 180 miles west of Medicine Hat, on the main line of the Canadian Pacific Railway, on an island in the Bow River, is a well 1886 feet deep, yielding 8,365,000 cubic feet a day."

Buying Coal on its Calorific Value.—At the close of a paper presented by Mr. S. A. Taylor at the last meeting of the American Mining Congress, he expressed the following opinions: "That while the B.Th.U. method of purchasing coal, so far as the purchaser is concerned, may temporarily prove a good thing, it will in the end result in his paying much more for his coal. That, so far as it affects the conservation of fuel, it will prove a failure. That it is quite possible to so study the method and conditions under which fuel may be used as to effect a very great deal more economy to the purchaser, and at the same time not destroy the stability of the business of the producer of coal, which is a condition much to be desired—as a matter of fact, it is a necessity—and something which will not obtain should the B.Th.U. method of purchasing fuel come into general practice. That where this is used, the agreement should state specifically the method of sampling the coal for testing; the method of determining the B.Th.U., preferably with the bomb calorimeter; and the person who would make the tests. Also, in case of dispute, to have an arbitrator, agreeable to all parties in any way interested, named in the contract."

Use of Tar on Roads.—In an article, on the development of modern road surfaces, in the "Journal of the Franklin Institute" for October, Mr. W. H. Fulweiler divides the methods of applying tar into three general heads: (1) Brushing with a hot coating of coal tar, and dusting it lightly with sand, which is in general use in France. (2) Painting the surface by machine, and dusting with sand, which is in general use in England. (3) Coating the surface with a fairly heavy layer of hot tar or tar compounds, and then covering with a light coat of screening—the surface being finally rolled. According to an abstract in "Nature," the latter is the general system adopted in America, and seems to be better adapted to the rougher surface of American roads. A refined grade of tar, considerably heavier than that employed in France or England, is used, having more body and greater binding properties, and the coating applied is about twice as heavy. A light coating of clean gravel or fine stone chips is then put on instead of sand, and rolled; thus renewing the wearing surface, and filling the voids better than can be done by the use of sand. The treatment produces deeper penetration and more lasting effect, and succeeds best on macadam roads. It is practically mud-proof, absolutely free from road dust, apparently proof against heavy motor traffic, and most satisfactory for American conditions. The cost is higher than the French and English methods.

Gas-Producer Tests.—In the review of the technical and mechanical progress made in the gas industry during the past twelve months which Mr. Irvin Butterworth laid before the American Gas Institute at their last meeting, from which extracts were given in the "JOURNAL" last week, he referred to some tests of gas-producers carried out by Professor R. H. Fernald, and dealt with in a recent bulletin of the United States Geological Survey. The investigations were undertaken as a result of the great inaccuracies which he said were apt to creep into tests of short duration, due principally to the practical impossibility of bringing the fuel bed to the same condition at the end of the test as at the beginning. The conclusions drawn by him are summarized as follows: "That throughout a test the fuel bed should be maintained in uniform condition, with regard to both the character of the fire and the thickness of the bed, but that, failing in this, special care should be exercised to see that the fuel bed is in the same condition and of the same thickness at the close of a complete test, or at the end of a test period, as at the beginning; that a test should never be started when the producer has been standing idle for some time with banked fires, as the fuel bed will not be in the average condition under which it will be required to work during the test; that if, as the appointed hour for closing the test approaches, the fuel bed is not in proper condition, the time of closing the test should be postponed until the bed naturally assumes the proper thickness and character. No forcing of conditions should be allowed simply to bring the test to an end at a previously determined hour."

ASSOCIATION OF WATER ENGINEERS.

The Fourteenth Winter Meeting of the Association was held last Friday and Saturday, at the apartments of the Geological Society, Burlington House, W., under the presidency of Mr. ROBERT ASKWITH, M.Inst.C.E., of the Weardale and Consett Water Company. There was a good attendance of members.

Confirmation of Minutes.

The SECRETARY (Mr. Percy Griffith) read the minutes of the annual meeting held at Durham on June 10 to 12; and these were confirmed.

Papers and Discussions.

The PRESIDENT said he was sorry to have to announce the postponement of Mr. G. N. Yourdi's paper on "Reservoir Outlets." Mr. Yourdi had been unwell, and so was unable to complete the paper; but he had promised to have it ready for the summer meeting. The members would regret that a paper of so much promise should not be read that day. But the pleasure was only deferred.

The papers were taken in the following order:

Friday.—"Public Water Supply for Fire Extinguishing," by Mr. C. W. S. OLDHAM, of Ipswich. "Evaporation from Water Surfaces," by Mr. SIDNEY R. LOWCOCK, M.Inst.C.E.

Saturday.—"A Sterile Boring in the Inferior Oolite (Somersetshire)," by Mr. WILLIAM PHELPS. "Ferro-Concrete as Applied to Water-Works Construction," by Mr. HARRY W. TAYLOR, Assoc.M.Inst.C.E.

Appointment of Scrutineers.

On the nomination of the PRESIDENT, Mr. James Dewhirst and Mr. A. J. Price were appointed Scrutineers of the balloting-papers for the Council and officers for the ensuing year, as well as for new members.

Election of Office-Bearers and New Members.

At the close of the discussion on the paper by Mr. Phelps on Saturday morning, the PRESIDENT announced that the result of the examination by the Scrutineers of the balloting-papers had resulted in the election of the following gentlemen to office in the ensuing year:

President.—Mr. William Henry Humphreys, of York.

Vice-Presidents.—Mr. Edward Sandeman, of the Derwent Valley Water-Works, and Mr. J. Spiers Pickering, of Cheltenham.

Ordinary Members of Council.—Mr. Easton Devonshire, of London; Mr. George Greenslade, of South Hants; Mr. Frederick Griffith, of Leicester; Mr. H. Ashton Hill, of the South Staffordshire Water-Works Company; Mr. William Matthews, of Westminster; Mr. Thomas Molyneux, of Stockport; Mr. C. Clemesha Smith, of Wakefield; Mr. R. H. Wyrill, of Swansea; Mr. J. J. Lackland, of St. Helens; and Mr. Frederick W. M'Cullough, of Belfast.

Honorary Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

It was also announced that the following new members and associate-members had been added to the roll:

Members.—Mr. K. P. Hawksley, of Westminster; Mr. C. B. Newton, of Hull; Mr. J. S. Sharland, of Geelong, Australia; and Mr. J. H. Willoughby, of Santos, Brazil.

Associate-Members.—Mr. W. R. Jenkins, of Cardiff; Mr. J. O. Jones, of Jersey; Mr. H. C. Rimell, of Cardiff; Mr. J. C. A. Roseveare, of the Derwent Valley Water-Works; Mr. J. W. Wilkinson, of the Derwent Valley Water-Works; and Mr. Alfred Peirce, of Richmond.

Mr. W. H. HUMPHREYS (York), in acknowledging his election to the office of President, said that nothing would be lacking on his part to make his year of office a success. His Chairman had been good enough to come to the meeting that morning; and perhaps he would like to say a few words.

Invitation to York.

Sir JOSEPH SYKES RYMER remarked that it was a great pleasure to him to be present at the meeting on the occasion of the election of the Engineer of the York Water-Works Company to be the President of the Association. Those who were connected with the York Company took it as a compliment that the members of the Association should consider that one of the Company's officials should be of that standing which qualified him to take such a position as President; but they felt sure the members had not made a mistake in the confidence they had placed in Mr. Humphreys. It would be a great pleasure for his (Sir Joseph's) colleagues and himself to meet the members at York in the summer, and to show them what they were

doing there. They claimed to be second to none at York in their water-works machinery—engines, boilers, and so forth, and especially in the filtering of the water. But they were always willing to learn; and they tried to improve. They were quite conscious they had not reached perfection; but if the members went to York, and could show them anything whereby the Company could advance, they would be only too delighted. He should like to add a word of congratulation to the members of the Association on the vocation in life that they had chosen. He hoped they were all properly remunerated by their various companies and authorities. [Laughter.] Independent of that, however, water engineers had the satisfaction of knowing that they were doing a great amount of good. There was no more interesting or useful vocation than to endeavour to send out to the communities a wholesome and satisfactory supply of water. He trusted the new President and all the members would have a happy and profitable year.

The PRESIDENT, in acknowledging the kind remarks of Sir Joseph, thanked him and his colleagues heartily for the invitation to visit York next summer. The Association were glad indeed to accept it. Sir Joseph would find water engineers were always willing to give good advice. They were not a shy or bashful body. If they saw anything that they thought was wrong, they would not hesitate to say so.

Control of Accounts of Municipal Authorities.

There was a discussion on this subject; and unanimously the following resolution was passed: "That the Association of Water Engineers approves, and endorses, the action of the Committee of Municipal Trading Departments in their opposition to the proposed centralization of the control of their accounts."

Votes of Thanks.

Proposed by the PRESIDENT, and seconded by Mr. W. MILLHOUSE, a hearty vote of thanks was passed to the President and Council of the Geological Society for the use of their rooms for the meeting.

Mr. WILLIAM MATTHEWS (London) moved a vote of thanks to the authors of the several papers. The papers had been exceedingly interesting and entirely useful, as had also been the discussions.

Mr. FREDERICK GRIFFITH (Leicester), in seconding, said he regarded the papers as being above the average, and so had been the discussions.

The motion was unanimously carried.

On the proposition of Mr. H. ASHTON HILL, seconded by Mr. C. SAINTY, a cordial vote of thanks was passed to the Scrutineers.

This completed the business before the meeting.

PERSONAL.

Mr. E. W. BOOTH has resigned his position as engineering assistant in the Water Department of the Bolton Corporation, and the Committee have decided to advertise for a successor.

Mr. W. S. M'GREGOR, representing Messrs. Biggs, Wall, and Co., has accepted for the third time the position of Chief Engineer of the Imperial Ottoman Gas-Works, Constantinople, and will shortly leave England to take up his new duties.

At the meeting of the Paignton Urban District Council last Thursday, the Water Committee reported that four candidates for the office of Water Engineer appeared before them, and they recommended the appointment of Mr. J. C. HAWKINS, of the Water Engineer's office, Cardiff, as Chief Water Engineer to the Council, at a salary of £200 per annum, rising by annual increments to £250 per annum. The recommendation was approved.

We learn that Mr. G. P. POOLE has resigned the position of Manager of the Madeley (Salop) Gas-Works, in which he succeeded his father, who had filled it for upwards of thirty years. In the early days of his professional career, Mr. Poole was Manager of the Broseley Gas-Works; but after three years he left to take a similar appointment with the Sutton and Hooton Gas Company, with whom he remained more than twenty years. He left their service to enter that of the Madeley Company, and is now leaving it on account ill-health.

Mr. FRANK H. ROBINSON, the Engineering Assistant to Mr. J. G. Newbigging, M.Inst.C.E., of Manchester, was elected an Associate Member at last Tuesday's meeting of the Institution of Civil Engineers. Mr. Robinson was educated at the Manchester Grammar School, and, after three years' training with Messrs. Thomas Newbigging and Son, has been for the past 6½ years with the Manchester Corporation—now at the Gaythorn Gas-Works. Mr. Robinson's paper, on the "Design and Construction of a Large Gasholder Tank at Manchester," appeared in the "JOURNAL" as recently as the 30th ult.

OBITUARY.

DR. LUDWIG MOND.

WE regret to record the death, at the age of 70, of Dr. Ludwig Mond, which occurred at his London residence in Avenue Road, Regent's Park, early last Saturday morning, after a protracted illness. The deceased was the Managing-Director of Messrs. Brunner, Mond, and Co., Limited, and had occupied several important positions in the scientific world; being chiefly known for his great achievements in chemical research. He was born at Cassel in 1839, and was educated at the Polytechnic in his native town; afterwards proceeding to Marburg University, where he studied chemistry under Hermann Kolbe. Subsequently he went to Heidelberg, to complete his studies in Bunsen's laboratory.

After having held several chemical appointments in Germany, he came to England in 1862 with the object of introducing his process for the recovery of sulphur from alkali waste. For a short time he was associated with Mr. John Hutchinson, of Widnes; and while at these works he perfected his process. In 1864, he returned to the Continent to undertake the erection and management of a Leblanc Alkali Works at Utrecht. About three years later he settled in England, and subsequently became a naturalized British subject. In the course of his travels, Dr. Mond became acquainted with M. Ernest Solvay, of Brussels, the inventor of the Solvay process; and, having acquired the English patent rights, he established in 1873, with Mr. J. T. Brunner (now Sir John Brunner) as a partner, the firm of Messrs. Brunner, Mond, and Co., which was converted into a limited company in 1881. The works which they erected at Winnington and elsewhere are now the largest alkali works in the world, and employ something like 4000 men.

Another question to which Dr. Mond applied himself was that of the economical utilization of fuel; and the outcome of his work on this subject, which began about 1879, was the invention of the system of producing power gas known by his name. The development of this system, and the steps taken to supply the resulting gas on a large commercial scale in South Staffordshire, will be fresh in the recollection of our readers.

Always interested in the advancement of science, to further this object, Dr. Mond founded and endowed in 1896 the Davy-Faraday Research Laboratory at the Royal Institution. In addition to this, he contributed to the progress of science in this country; the principal institutions to which his generosity was chiefly directed being the Royal Society (of which he became a Fellow in 1891), the Royal Institution, the Universities of Cambridge, Liverpool, and Manchester, the University College, London, and the Lister Institute of Preventive Medicine. In recognition of his many services to science and industry, he received several honours and honorary appointments. He was Grand Cordon of the Crown of Italy, and a member of the Accademia dei Lincei; and he received honorary degrees from Padua and Heidelberg, and from the Victoria and Oxford Universities. He was President of the Society of Chemical Industry in 1889, and of the Chemical Section of the British Association at its Liverpool meeting in 1896. He was chosen President of the Chemical Society this year; but for reasons of health he was unable to serve.

Dr. Mond leaves two sons—Robert (the elder), the Hon. Secretary of the Davy-Faraday Research Laboratory; and Alfred, who represents Chester in the Radical interest in Parliament.

The death is announced of Mr. GEORGE SWAINSON, who retired from the position of Borough Treasurer of Bolton early in the present year, after occupying it for 33 years. Mr. Swainson was elected first President of the Institute of Municipal Treasurers.

Mr. THOMAS WRIGLEY, the Chief Committee Clerk to the Manchester Corporation, died at Rhyl on Friday last, at the age of 62. Mr. Wrigley had a serious breakdown in health in the summer, and had been absent from duty for some three months. He served under 26 different Mayors and Lord Mayors.

Mr. ALFRED WALKER, who died last week in his seventy-second year, was for some time Chairman of the Huddersfield Gas Committee; but his most notable service was as Chairman of the Water-Works Committee—a position that he held from 1900 until September, 1908. During the municipal years 1878-9 and 1879-80, he was Mayor of the borough.

The death took place at Knowle, Warwickshire, on Wednesday, of Mr. EDWARD TANGYE, one of the five brothers who built up the engineering business of Tangyes Limited, at Cornwall Works, Birmingham. Mr. Tangye, who was in his 78th year, in his early days took an active share in the mechanical department of the bnsiness; but his health gave way, and he went to live in Cornwall. A few years ago he returned to the Midlands, and took up his residence at Knowle. He leaves a widow and family.

The Late Mr. Barber's Position.—The "Birmingham Mail" says: We understand that it is doubtful if the Birmingham Gas Committee will take any steps before Christmas to fill the vacant secretaryship at the Gas Department created by the death of Mr. G. Hampton Barber.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 772.)

THE Stock Exchange had its ups and downs last week. At the start, everything was going quite well. The rising tide in the choicest departments was still running strongly. Consols and their gilt-edged associates were buoyant; Railways made a broad advance; and the Foreign Market was strong. The cheerfulness was widespread enough to include many of the more speculative lines. But before long the big rise had its inevitable sequel and reaction. Monday was perhaps the best day (the demand for investment not having worn itself out); and Consols advancing a little more. On Tuesday, the Railway Market was very busy, and prices were full of rise. Consols, however, paused at their zenith, and then fell back a little in the face of realizations to secure profits. Wednesday was much the same. The general tone was good, and Railways were still a centre of attraction; but Consols kept on giving way. Business in general became quieter on Thursday; and the profit-snatching operations reached the Railway Market. On Friday, markets were inactive and irregular. Government securities and the Railway Market were weaker; but the Foreign, American, and South African were stronger. Saturday was quiet and dullish, and pretty well every department was rather weaker if it moved at all. In the Money Market, there was a plentiful supply on easy terms. On Thursday (as had been generally forecast), the Bank of England rate was lowered to 4½ per cent. Before the close of the week, market rates hardened. Business in the Gas Market was not up to the average in point of activity. Some issues which are usually in evidence were not touched at all, and the leading lines were rather devoid of animation. One or two issues, generally quiescent, woke up a bit; but they could not restore an equilibrium. However, the tone was quite firm and steady; and all changes of quotation—albeit few in number—were in the upward direction. In Gaslight and Coke issues, the ordinary plodded along quietly without any change; all transactions being within the range of 102¾ and 103½. In the secured issues, the maximum made 87¾ and 88½, and the preference 104. There were many dealings in the debenture at from 82 to 83¼. South Metropolitan was quiet and unchanged at from 119¼ to 120¼; and the debenture realized 82 and 82½. In Commercials, the 3½ per cent. made from 103 free to 104, and the debenture 81. Among the Suburban and Provincial group, Alliance and Dublin was dealt in at 17½, Brentford old at 253, ditto new at 192, Brighton ordinary at 151¼, British at 43⅜, Hastings 3½ per cent. at 93, Lea Bridge at 120½, South Suburban at 119½ free, Wandsworth "B" at 139¼ free, and West Ham preference at 127¾. In the Continental companies, Imperial made from 176½ to 177, ditto debenture 94½, Union 98, ditto preference 140½ (both *cum div.*), European 24⅝ and 24¾, and ditto part-paid from 18⅝ to 18½. Among the undertakings of the remoter world, River Plate changed hands at from 16½ to 16¾.

ELECTRICITY SUPPLY MEMORANDA.

To Terrorize Householders—A Stale Dish Re-served—Doctors Differ—Want of Knowledge—Dr. Haldane's Experiments in Closed Rooms—Judgment of a Competent Committee—Sundry Points.

THE purveyors of electricity in London have so much difficulty in obtaining additional domestic consumers, that they are seeing just now if they cannot capture some by striking terror into their hearts by telling them all the most horrible things possible about the unhygienic properties of gas, and the nicest things possible about the sanitary qualities of the electric light. They are disseminating the information through the "Electrical Bulletin;" and from the energetic Editor, Mr. Spencer Hawes, we have received, with his compliments, a copy, presumably to let us know how cleverly the editorial work of the "Bulletin" is conducted. But on this occasion we regret to see the work was too much for even the versatile Mr. Hawes; so he had to take Dr. J. N. Goldsmith as a collaborator. Between them they have prepared a wonderful *réchauffé* dish for the consumption of householders of London. It is mostly very stale stuff that they have re-served; and not in a single place can we find that they have added to the stock of knowledge through their combined mental effort. They have drawn largely from good, but academical, Dr. Haldane, and dipped deeply into the Home Office reports referring to factories and workshops, as though (how very hard put to it they are!) the conditions in workshops and factories—where gas is, in all too many cases, from an objection to departing from custom, allowed to flare away from flat-flame burners, and is used in any crude fashion for heating tools, and so forth, and wherein producer or suction gas is now frequently employed—at all represents the conditions obtaining in the home. If the electricians are so hard pressed that they have to attempt to frighten people away from gas to electric lighting, do let them go about the business, if they can do so, in an honest manner, and not stoop to crass deception. Then, again, like a couple of mischievous boys, Mr. Spencer Hawes and his helpmate Dr. Goldsmith have set Professor Vivian B. Lewes and Dr. Rideal in opposition. That is unkind; but we cannot see one single respect in which the compilers have supplied the material that proves that either Professor Lewes or Dr. Rideal is wrong in his assertions. They quote Dr. Parkes, Dr. Haldane, Dr. Newsholme, the Medical Officer of the London County Council; but there is no difficulty in quoting to the contrary authorities still greater in the scientific world than these. But we cannot hope in the space of these notes to deal entirely with matter that occupies sixteen columns in the "Bulletin," or to produce all the rebutting evidence. The ground has been traversed time and again in these columns. Facts remain facts; and all the appeals to Dr. Haldane and to the Home Office report on Factories and Workshops will not upset those facts. One fact is that in the past twenty years the consumption of gas in Great Britain has more than doubled; and Mr. Hawes and Dr. Goldsmith fail to produce one iota of evidence that, in consequence of this doubling of use, the general health of the community has degenerated or that the mortality has increased. It is good to apply practical tests of this kind to the superstitions of a by-gone day, to which superstitions the electrical folk are in their extremity clinging with a tenacity that is both amusing and instructive to their competitors. It is to say the least interesting in this connection to see the reliance placed on the Home Office reports in regard to factories and workshops. We rather thought the electrical industry had had enough of the Home Office and their regulations applying to the use of electricity in workshops and factories. It was not long since they were talking, with remarkable fecundity, of red-tapism and official fads; but now they find in the same quarter friends in their need.

We have said that much of what is presented in this "Electrical Bulletin" is stale and little original. The quotations that preface the article by the joint authors bear that characteristic. One of them is from a paper by Sir Aston Webb, in which he says that "carefully regulated incandescent electric lighting is the best, and greatly simplifies the ventilation. Gas is better avoided." Men, of course, have a perfect right to change their opinions, when they find that the former ones were erroneous. At the meeting of the Royal Institute of British Architects on May 17 last, Sir Aston Webb was a speaker. He stated that, having recently, owing to illness, been compelled to have a fire in his bedroom, he was convinced that a gas-fire was preferable to a coal fire. On the same occasion, Dr. H. A. Des Vœux also mentioned that "he is a strong believer in gas for heating houses, and especially for bedrooms. There are now 500,000 gas-stoves in London; and if gas were deleterious to health as some people thought, they would have heard of its effects before this." Again, as was stated a fortnight since in the "JOURNAL," during the past two years upwards of 1000 gas-fires have been fixed for members of the medical profession in London. We should like to know from Dr. Goldsmith whether the medical men represented by these 1000 gas-fires are inferior to him in judgment. The question is a delicate one; and perhaps as to what Dr. Goldsmith thinks, his modesty will not permit him to give expression.

The authors devote about four columns to Professor Lewes and Dr. Rideal, on the question of bacteria cremation by gas; but it is clear that here and in other places personal knowledge does not assist the criticism by Mr. Hawes and Dr. Goldsmith. We will leave the bacteria, with a recommendation to them if they desire prolonged life to get into places electrically lighted, only shunning those, which are few and far between, where the mercury-vapour quartz-tube is in use. To get into the ultra-violet rays of this light means certain death. Then the attention of London householders is called to the "destructiveness of sulphur acids"—their "propensity for tarnishing and destroying household equipments, decorations, and ornaments." Mr. Spencer Hawes and Dr. Goldsmith have a peculiar affection for Dr. Haldane. They will therefore be displeased to learn that this particular bulwark of theirs, in his evidence before Lord Rayleigh's Committee on Gas Testing in the Metropolis in 1904, said: "The sulphuric acid is, I think, mostly due to the general London air; it is only partly due to the gas. I should attribute *most of it* to the sulphuric acid present in the outside air from the combustion of coal," which (we may add) is largely contributed to by the electricity stations of London. Following up this, the joint authors refer to "some startling results that were brought before the Pharmaceutical Society at Edinburgh lately;" one of the startling results being the destruction of the leather cover of the seat of a chair that had been standing near a large gas-fire. We refer the authors to our "Memoranda" in the "JOURNAL" for Jan. 12 last for a criticism of this startling result; and on the subject of carbon dioxide and organic impurities in air, there is an article in our issue for Feb. 9 (p. 360) that may be of interest to them, and supplement their present knowledge.

The matter of sulphur compounds is next taken up; and the surprising thing is that Mr. Hawes and Dr. Goldsmith selected Dr. Haldane to support them in this connection. In treating of this aspect of the subject, the joint authors set off by disclosing their personal ignorance. They say: "The sulphur in the gas, after the partial purification which it undergoes in the gas-works, exists chiefly as carbon bisulphide, with a small proportion of *sulphuretted hydrogen* and organic sulphur compounds. These sulphur compounds are inflammable, and yield a mixture of sulphurous and sulphuric acids when the gas is burned in a flat-flame burner, while *they appear to be* completely oxidized to sulphuric acid in the flame of an incandescent burner." We would suggest that this weighty statement should be reconsidered by the authors, and revised in at least one essential particular—that as to the sulphuretted hydrogen—as it may cause ridicule among people who receive the "Bulletin" and who happen to know

more about the matter than these dabblers in the chemistry of gas and gas lighting. Probably they have got a little mixed over a statement in an article which has been of enormous value to them, that "the sulphur contained in *crude un*purified lighting gas is present chiefly as sulphuretted hydrogen; about one-tenth being present in other forms, chiefly as carbon bisulphide." They take tightly hold of the coat tails of Dr. Haldane, and quote from articles by him in the "Journal of Hygiene" on "The Air of Factories and Workshops" and "The Relation of Sulphur in Lighting Gas to Air Vitiation." We have gone far since Dr. Haldane published those articles in 1902 and 1903; and in the succeeding year—1904—we learned a great deal about the unsound foundation on which the learned Doctor's opinions are based. Dr. Haldane is one of those scientific men who occasionally are most unscientific in their methods of procedure. The authors themselves ought to have seen that Dr. Haldane's conclusions were egregiously unjust and unacceptable from the very fact that they themselves quote: "In his experiments, gas was burned in a *closed* room; and the degree of contamination of the air was ascertained by carbonic acid estimations." Gas is not, as a rule, burned in "closed" rooms (such as those in which Dr. Haldane conducted his experiments at the Physiological Laboratories at Oxford) in dwelling-houses, without the ordinary means of ventilation. Dr. Shirley Foster Murphy, questioned by Lord Rayleigh, threw some light upon the character of Dr. Haldane's experiments, in giving evidence before the Board of Trade Committee on Testing Gas in 1904. Dr. Haldane had submitted his evidence before Dr. Murphy was called; and the latter had, in the meantime, been to Oxford to witness a repetition of the experiments. In Dr. Haldane's first experiments, he used a room of only 900 cubic feet capacity (*with the register of the fireplace closed*) for the sulphur experiments; and the second room had a capacity of 5500 cubic feet, with *no* fireplace, and half-a-dozen flat-flame burners fixed in it, each passing 10 cubic feet per hour! The character of the experiments witnessed by Dr. Murphy in other two rooms, is explained by an editorial comment in the "JOURNAL" at the time; and this may be quoted:

> These observers took a couple of rooms of a capacity of some 6000 cubic feet; *the windows and doors were kept closed, and there was no fireplace in the rooms.* Can this be called an ordinary dwelling-room? Then in each of these shut-up rooms, they flared away gas at the rate of 11·8 cubic feet an hour, which Dr. Murphy said was equal to about the use in these apartments of three flat-flame gas-burners. Why did they not try one incandescent burner? The gas burnt in one of the rooms, they packed with bisulphide of carbon until the sulphur in the gas reached about 36 grains. Then these two scientific men, another Doctor, and three ladies alternately entered the two rooms [half-a-dozen persons altogether]—all, on Dr. Murphy's admission, knowing more or less that one room was undergoing a somewhat different treatment from the other. They found what they sought. That they did so is not marvellous, when one considers the conditions of the rooms, and the method of treating and using the gas. And this passes in places for scientific research! We earnestly protest against its injustice, and hope—though the hope we fear is a vain one—that the gas industry will be delivered from all such unfairness in the future. A more practical test than the experiments applied to the gas by these doctors is found in the reply of Dr. Murphy, that he had never heard of people complain of the gas supply who were working in towns where the sulphur impurities are left in the gas; and again, answering another question, he stated that he did not think that, if the sulphur compounds other than sulphuretted hydrogen were left in the gas, there would be any specific damage to health.

On the same point, Dr. Haldane said: "It is unpleasant when you get a perceptible quantity of oxidized sulphur in the air; but I do not know anything to lead me to suppose that it is actually injurious to health." Mention is made in the quotation from our editorial columns of five years ago of the fact that bisulphide of carbon was put into the gas by Dr. Haldane; and, in his evidence, Dr. Murphy stated that he could not say whether there would be any difference between the burning of pure bisulphide of carbon mixed with gas and the sulphur compounds there would be in ordinary gas. These are the experiments, in *closed* rooms, upon which Mr. Hawes and Dr. Goldsmith place so much reliance; and we ask them whether they honestly believe them to be fair tests, and whether they would accept them as such on behalf of electric lighting. If not, then let them say so in the next issue of the "Electrical Bulletin." They might also at the same time point out that Dr. Haldane was effectually disposed of by the Board of Trade Committee's report in 1904—the Committee consisting of Lord Rayleigh, Sir W. Abney, Dr. R. Farquharson, Mr. William King, and Mr. J. Fletcher Moulton, K.C. Consider those names, and then this statement in their report:

> It is not disputed that only a small percentage of the gas undertakings in the United Kingdom (whether in the hands of Companies or Local Authorities) are required to take these sulphur products out of the gas they supply. Nevertheless, it does not appear that any complaints are made by the inhabitants of other districts on the ground that the gas unpurified causes injury to health, or is more destructive to articles such as leather, &c., than it is supposed to be in London. In the face of this striking fact, the Committee are of opinion that those who contend for the maintenance of the clauses relating to sulphur compounds (other than sulphuretted hydrogen) have not sufficiently shown that their abolition in the case of the London Companies would be detrimental to the public.

Are Mr. Hawes and Dr. Goldsmith prepared to dispute the competence of Lord Rayleigh and the other members of the Committee to form a correct judgment in this matter?

We do not know that there is any value in further traversing an article from the pen of a pair of writers who have obviously no personal knowledge of these matters, and who rely so confidently upon the results of experiments of the character exposed here. But two or three points more may receive passing remark. In the section of the article on "Scientific Ventilation," we do not see anything about the complaints as to the conditions of the electrically lighted Law Courts and the new Central Criminal Court, nor do we observe any reference to the statements in the last report on Factories and Workshops as to the great improvement effected in the lighting of such places where incandescent gas-burners are employed. Nor do the authors quote Dr. Haldane's statement, referring to a table in the paper on the "Air of Factories and Workshops:" "The table shows clearly the great advantages of incandescent mantles. Their much more general employment in factories and workshops is very desirable with a view to avoiding excessive vitiation of the air, and at the same time obtaining a good and perfectly steady light." As to "Poisonous Emanations of Partially Burnt Gas," we should like the learned Mr. Hawes and Dr. Goldsmith to explain what they mean by this statement: "With varying gas pressures and inverted gas-burners, especially when they are not nicely adjusted, *considerable* quantities of partially consumed gas may easily escape into the rooms." How, and from where? What, too, is meant by this gas being "*heavily charged* with carbon monoxide." Let us have an illustration in figures. Then, as to the "Potentialities of Gas Leakage," interior gas-pipes ought not to be allowed to leak; it is the fault of the consumer if they do. As to the "Lancet" and its traditional efforts in arousing terror in the public mind, we may refer the authors to a couple of leaderettes in our issue for Aug. 18, 1908, the first of which is headed "The 'Lancet' finds a Mare's Nest."

The section of the "Bulletin" containing the old, old electrical arguments as to the relative cost of electricity and gas must also be passed over, in view of the length to which this article has already extended. All the mildewed arguments are brought forward once more by Mr. Hawes; and their repetition indicates the poverty of the electrical land. Figures are given to show where in cases money has been saved by displacing gas by electricity. We have not sufficient space to quote the thousands of cases that gas undertakings could furnish us with of savings effected by the eviction of electricity and restoring gas, which figures would be anything but "farcical." The "Wasteful Bye-Pass," "Mantle Renewals and Burner Repairs," are dealt with in the approved electrical fashion; and a paragraph appears headed, "A Great Public Institution favours Gas"—viz., the Metropolitan Asylums Board. The Editor has quite—of course, inadvertently—overlooked the report of a Committee of the Local Government Board in which it was stated that there is no justification for adopting electricity where gas at present exists.

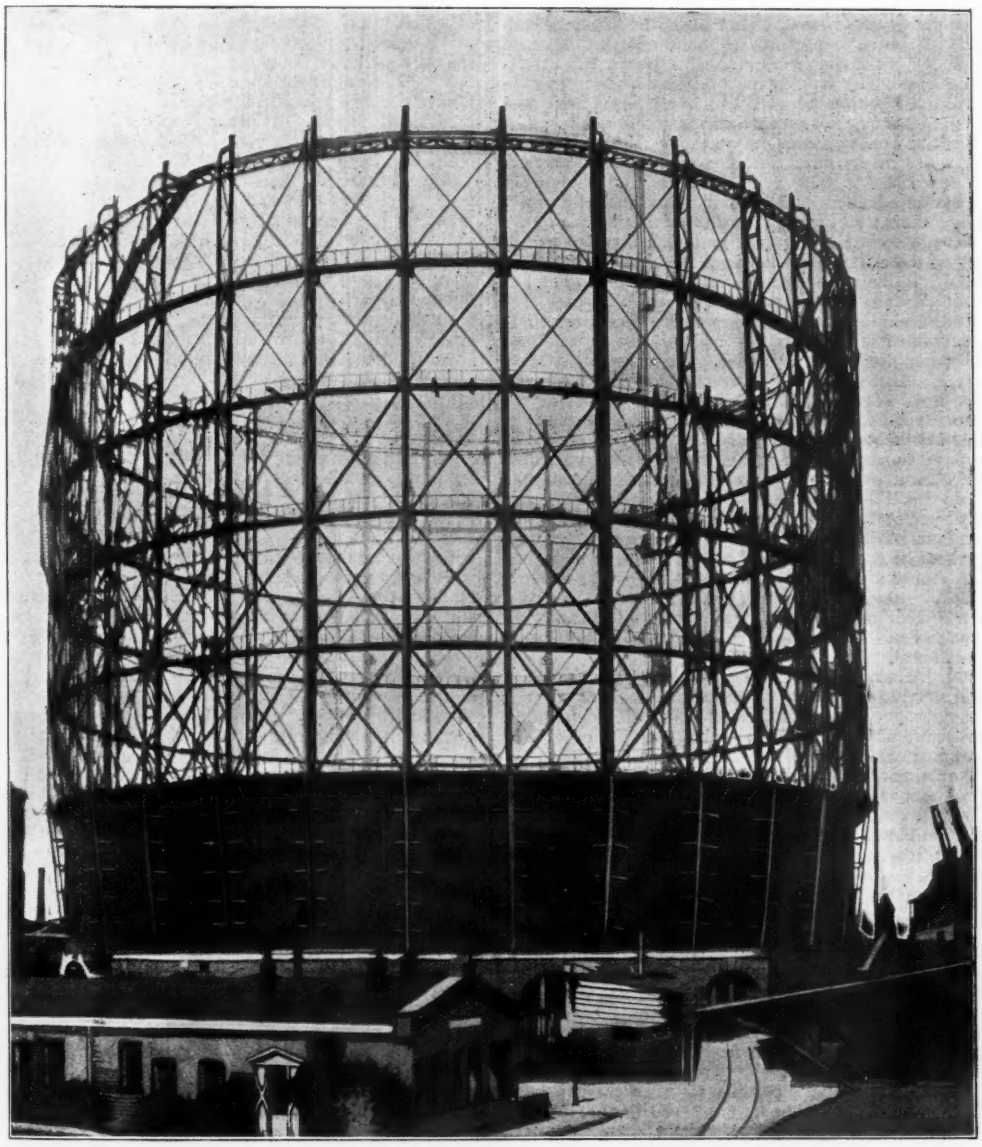
New Gas for Balloons.

According to information from Berlin contained in the Engineering Supplement to "The Times" last Wednesday, Dr. W. von Oechelhaeuser, the General Manager of the German Continental Gas Company, has been carrying out some experiments with the object of producing a new kind of gas suitable for balloons. According to our contemporary, they show "that the decomposition of ordinary coal gas in vertical retorts yields in normal operation a balloon gas of a specific gravity of about 0·225; so that to one cubic metre would correspond a lifting power of about 1 kilo. According to the statutes and regulations of the International Association of Aeronauts, the lift of one cubic metre of lighting gas has up to the present been calculated at 0·700 kilo. and that of hydrogen gas at 1·050 kilos. Hence, on the basis of these figures, the lifting power of the new balloon gas would be to that of hydrogen as 1 : 1·050, and by its assistance a balloon of a capacity of 1000 cubic metres would be able to lift 300 kilos. more than one of the same capacity filled with coal gas; or, alternatively, the size of a balloon with the same lifting power could be reduced by 30 per cent. This balloon gas contains upwards of 80 per cent. of hydrogen; while the content of methane is reduced to 5 or 7 per cent. The gas has only a very slight smell, and contains neither benzol nor any other heavy hydrocarbons capable of attacking the balloon cover." Dr. Oechelhaeuser is at present engaged making experiments to ascertain whether the process is adaptable to horizontal retorts.

New Method of Preserving Wood.—Some recent experiments by two Swedish engineers, MM. Heidenstam and Friedemann, on the preservation of timber have resulted in the introduction on a commercial scale of a new chemical preservative. The substance is known as cresol-calcium, and is produced by the action of cresol ($HO . CH_3 . C_6 H_4$) on slaked lime. A solution of the resulting compound having a 10 to 15 per cent. composition is used for impregnation, which is carried out in exactly the same manner and with the same apparatus as is employed for creosoting, with the exception that with the new material the temperature of 70° to 80° C. required for the creosote process is not necessary. The advantages claimed for the method are its cheapness, the cleanliness of the treated material, and its inflammability. In addition, a feature of the process is said to be the ease with which the right amount of preservative fluid can be given to the wood,

THE CATASTROPHE AT THE HAMBURG GAS-WORKS.

THE catastrophe which occurred at the Grasbrook Gas-Works of the City of Hamburg on Tuesday afternoon last is reported to have been the heaviest which has befallen the city since the sinking of the steam-boat *Primus* there. The Grasbrook works have, as "JOURNAL" readers are aware, been recently undergoing extensive enlargement; and conspicuous among the new work was the gasholder of 200,000 cubic metres (7,060,000 cubic feet) capacity, which is the largest gasholder on the Continent of Europe, and undoubtedly the largest in the world constructed with an annular tank and with the contained cellar utilized for general purposes. The accounts which have so far come to hand of the accident are by no means clear in regard to the causes and details of the occurrence; the eye-witnesses and reporters having been naturally chiefly impressed with the magnitude of the disaster and the consequences of it. The daily Press, both in England and Germany, has generally referred to the catastrophe as an "explosion;" but it is evident from the more trustworthy accounts that, if any explosion actually occurred, it was a secondary and minor incident of the mishap. With these prefatory remarks, we may proceed at once to give an account of the accident, prepared from the reports of eye-witnesses and of Press representatives as published mainly in the "Hamburger Nachrichten." At the close, some particulars will be given of the type of construction of the tank and gasholder.



THE HAMBURG GASHOLDER BEFORE THE ACCIDENT.

It must be realized in the first place that the accident has involved not merely the destruction of the largest gasholder on the Continent, but also so much of the surrounding buildings and plant that the Grasbrook Gas-Works are, for the time being, reduced almost to inactivity as a gas manufacturing station. The City of Hamburg is therefore suffering at present from a very inadequate supply of gas, and, except where there is electric lighting, the streets are only partially illuminated at night. A large number of lives—thirty, at least—have been lost through the catastrophe; and the number of severely injured amounts to from forty to fifty. Up to the time of the reports so far to hand leaving Hamburg, it had been impossible to ascertain definitely how many had been killed and injured by the accident, as the search of the *débris* is attended with much difficulty and danger; while many of the more severely injured who are now in the hospital may yet succumb to their injuries. In addition to the thirty deaths definitely known to have taken place up to Wednesday evening, the authorities estimated then that at least sixteen persons (few if any of whom could be alive) remained buried in the *débris*. Funds have been opened in Hamburg to relieve the families of those killed and incapacitated by the disaster.

The new gasholder, which was constructed in four lifts conjointly by the firms of F. A. Neuman, of Eschweiler, and the Berlin-Anhalt Engineering Company ("Bamag"), was taken over by the management of the gas-works on its completion on Nov. 6 last. It was filled for the first time with gas about ten days before the accident happened; and on the afternoon of the occurrence it was about half full, and therefore contained at the time about 3½ million cubic feet of gas. About a quarter past three in the afternoon of Tuesday last, many of the workmen engaged on the buildings round about the gasholder observed a sudden lifting of the bell, or of the uppermost lift of the bell, followed by an

equally sudden fall, and that by another lift. Foreboding no good therefrom, many of them took to flight, climbing or jumping down from the roof framings on which they were engaged.

The holder meanwhile sank once more, and a quantity of the water in the cups was forced out. At the same time, from beneath the holder and above the concrete ring, a large flame issued on the side that was nearest the town. At the moment also, enormous tongues of flame sprang out from the vault of the under-structure of the tank, destroying everything round about which was combustible or susceptible of injury by fire. The whole sub-structure of the gasholder, which consisted of strong iron girders with radial ribs and lateral ties, covered with masonry (cement concrete), became penetrated, and everything contained in the vault, including the canteen and kitchens, was at once buried in its ruins. Above it, the large volume of about 3½ million cubic feet of gas streamed out, burning into the open, illuminating everything to a great distance with its glare, and producing enormous clouds of smoke. In the immediate vicinity, the "explosion" gave the impression of a small earthquake; but there was no violent concussion, as the outflowing burning gas was not mixed with air. The enormous tongues of hot flame that roared forth from the arch of the sub-structure stretched across the whole length and breadth of the space intervening between the retort-house and the new coal-stores to the buildings on the opposite side. In the vault beneath the gasholder every living thing was naturally killed in a moment—crushed or roasted to death.

Some only of the workmen engaged on the framing of the coal-store in course of erection, and the men working in the retort-house on the opposite side, were able to be rescued. Some were driven down by the advancing flames, and others jumped down in order to escape them; so that many of these fell victims to the disaster, or were more or less severely burned. The flames also raged terribly on the side where the retort-house was in course of construction, and in the gangway between the two gasholders, in which men had likewise been at work. The window panes, and in many cases the window framings, also of the vault were shattered by the force of the "exploding" gas, as well as windows of the retort-houses facing the gasholder. The tongues of flame rushed forth for a short time only. Nevertheless, they set fire to all the combustible woodwork in the vicinity. The roof of the gasholder house near by, in which was the old gasholder containing about 40,000 cubic metres (1,400,000 cubic feet), being largely of wood, was fired by the flames; and ultimately this holder also was completely burnt out. It appears that only one section of the fire brigade was able to get to work on the burning holder. This section played on to it from the Elbe—from the direction of which the wind was blowing. The Chief of the Brigade, however, permitted the roof of the house of the old gasholder to blaze unchecked, as he feared injury to his staff from the explosion which was momentarily expected to occur in this holder. He was convinced that the extinction of the fire in this quarter could only be seriously taken in hand after the holder, with its 1½ million cubic feet of gas, had burst.

The hose was got in readiness against the time when the Chief of the Brigade should give the word for its employment on the burning gasholder house. Meantime, the roof of the building continued to burn; while the onlookers exchanged views as to what would happen when the holder itself burst. The technical men were of opinion that the contents would burn away with a large flame without extreme violence. Other people, however, anticipated that there would be an explosion; and that the gasholder would be blown into the air. The Chief of the Fire Brigade, in order to guard against all possible contingencies, gave orders at 4.30 p.m. for the circle from which people were excluded to be enlarged, though the order was scarcely necessary. Then the roof of the gasholder house collapsed; and the populace retired still farther in order to be safe from the explosion which was then momentarily expected. The police had, consequently, no work to do in keeping neighbouring streets clear, and were merely engaged in advising the officials at the river and wharf side buildings—only about 100 yards distant from the burning gasholder—to take to flight. Nevertheless, the impending disaster did not occur until about 4.45 p.m., when darkness had already set in. There was then a sudden mighty roar; and an immense blood-red sheaf of flame shot upwards to a height of about 500 feet, and spread tremendous heat to a great distance. A wide area was lighted up as if by daylight. Scarcely, however, had the magnificence of the scene been realized before the great blaze began to pale, and in a few seconds it was over. Some 1½ million cubic feet of gas had been burnt in that brief space of time. A great cloud of smoke issued from the yawning cavity of the unroofed gasholder. Then the fire brigade got to work on it, and soon overcame the danger of further spread of the fire.

It was now possible to gauge in some measure the extent of the disaster. The make of gas from the retort-houses, the settings in which had escaped injury, was diverted immediately after the collapse of the first gasholder. From one account, it would appear that the lids of the retorts were opened, and the gas was allowed to burn away at the mouthpieces. Another account says that the burning gas from the stacks of the retort-houses brightly illuminated the whole works. In front of the large gasholder, the *débris* of the accident was comparatively small; but the scaffolding, &c., of the buildings in course of erection was heavily charred. It had been attacked by the tongues of flame issuing from the understructure of the new holder. The vault of the latter was filled with iron girders, planks, brickwork, and cement piled up in absolute chaos. The gasholder, by its collapse and the pressure of the burning gas, had split up the roof of the vault. The lofty guide-framing of this holder, as seen by the light of the flames from the neighbouring holder, appeared comparatively little injured; but the walls of the house of the old holder projected skywards in a state of ruin. On the side adjoining the street there was an enormous gap, diminishing below to a crack, caused by the pressure of the liberated gases. This old gasholder is totally destroyed, and will have to be entirely re-built. The fire brigade continued its work until about 9.45 p.m., when it was considered safe to withdraw all but six of the firemen. Thousands of people, however, remained in the neighbourhood of the works until far into the night.

The Extensions at the Grasbrook Works.

It may be useful to give a brief account of the gas-works which supply the City of Hamburg, and in particular of the Grasbrook Gas-Works and the extensions which have been in progress there since 1907.

There are three gas-works at the present time in Hamburg, of which the Grasbrook works, situated between the Strand and the Magdeburg wharves, is the oldest. For many years, it was the only works in Hamburg. Its position on the tide-way of the River Elbe renders it accessible to steamers; so that the coal is landed on the works and bye-products are removed without intermediate transport. In other respects its situation is good, in that it is in the centre of the district which it supplies, and the mains connecting it to the distributing system are of a short and simple character. Thus the Grasbrook works is at the present time the central and most important factor in the gas supply of the city. The district supplied directly from it comprises the whole of the inner town, including St. Pauli and parts of St. Georg and the suburb of Eimsbüttel. The next most important works is the Barmbeck works, which for the time being has the largest productive capacity and supplies directly the districts on the right bank of the Alster, and Barmbeck, Eilbeck, Hohenfelde, Borgfelde, and Hamm. The third city gas-works is situated in the Ausschläger Elbdeich, and directly supplies the districts of Billwärder, Ausschlag, and Hammerbrook, as well as a portion of the inner town and of St. Georg. The distributing system directly connected with each of the three works is, however, joined up, so that all the works are in close co-operation, and one can supplement the supply to the district of another and equalize the load on any particular works. The regulation of the gas pressure throughout the whole district is controlled from the Grasbrook works, which thus form the central works of the undertaking. The maximum day's make of gas in the year 1894 amounted to 199,100 cubic metres (= about 7,030,000 cubic feet), and in the year 1906 to 362,400 cubic metres (= about 12,800,000 cubic feet). At the present time, the Grasbrook Gas-Works can make about 5,450,000 cubic feet in twenty-four hours and the Barmbeck works 6,000,000 cubic feet.

The Committee of the Corporation which has control of the gas and electricity supply undertakings for several years past had had in mind the establishment of a new works on the upper stream of the Alster. But while this project was under consideration, extensive changes took place in methods of gas manufacture; and before proceeding to recommend the Municipality to erect this fourth works, the Committee decided to reconstruct the existing works in a manner which would effect a large increase of their output. Even when the third of the existing gas-works was erected, it was found that improvements in the plant of the other works could be introduced. These consisted mainly in the adoption of machinery to displace manual labour as far as possible. Charging and drawing machinery was tried first experimentally at the Grasbrook works; and one of the three retort-houses there was then equipped with it. In 1907, it was decided to adopt stoking machinery at the Barmbeck works also. The existing systems of retort-settings having, however, been to some extent superseded in recent years by new systems, the Committee took the latter into their consideration. The great advantage of these systems is that they admit of the make of gas obtainable on a given area of ground space being very largely increased, while at the same time they afford easier methods of working. The new types of retort-settings were tried experimentally; and, as a result, the Committee recommended that a complete reconstruction of the Grasbrook Gas-Works should be put in hand. The chief feature of this reconstruction was the adoption of new systems of carbonization, which would increase the maximum output of the works from (approximately) 5,450,000 cubic feet to 15,890,000 cubic feet per diem. The erection of a water-gas plant at the Grasbrook works would further increase the productive capacity of the works to a total of 21,200,000 cubic feet per diem. Consequently, this works would be able to meet the increase in the consumption of gas for at least ten years. The Committee have, therefore, now postponed indefinitely the project for the erection of a fourth gas-works. It is ultimately intended to reconstruct in a similar manner the Barmbeck works; but a start was made on the Grasbrook works because, being the oldest of the three, its existing plant was more antiquated than that at the other works.

The Grasbrook Gas-Works has its three retort-houses and a coal-store disposed in the middle of the works. One of the retort-houses had been re-equipped with horizontal retorts and stoking machinery shortly before 1907. The other two retort-houses contained horizontal retorts of an older date without machines

for stoking. The settings would have had to have been replaced in any case within a short time. In the coal-shed between the Nos. 1 and 2 retort-houses a new bench of vertical retort-settings was erected experimentally in 1907, and brought into action shortly afterwards. To the west of these buildings, and adjoining the Harburger Strasse, were two gasholders; the larger being of about 1,765,000 cubic feet capacity, and the smaller of about 512,000 cubic feet capacity. The last-named is old, and would shortly be replaced. There is a third small gasholder of about 160,600 cubic feet capacity on the part of the works adjoining the Elbe, near by which is the coke yard. The purifying and apparatus houses are to the north of the retort-houses. It was decided that the new carbonizing plant should consist of carbonizing chambers of the Munich pattern, set on the slope, and each capable of receiving a charge of 11¾ cubic yards of coal. Whereas the old retorts were charged and discharged four times in 24 hours, the charge of coal is left in the chamber settings for 24 hours; so that the number of times of charging and discharging is reduced to one-fourth.

The total cost of the reconstruction was estimated at 14 million marks (£700,000). Of this sum, £100,000 was for the erection of a large new gasholder, £282,000 for the new carbonizing plant, £24,000 for new water-gas plant, £44,000 for new coal-stores, £49,200 for coal and coke handling plant, £110,000 for the construction and equipment of purifying and apparatus houses, £49,500 for the enlargement of the mains laid from the gas-works to the distributing system, and the remainder of the total estimated expenditure was for subsidiary plant and buildings. The expenditure on the Billwärder Gas-Works, which was erected in the years 1900-3, amounted to a total of about £370,000. The Grasbrook works, when the reconstruction is finished according to present plans, will have seven times the productive capacity of the Billwärder works, which at the time of its erection was equipped with the latest available plant and apparatus. The erection of another gas-works of approximately the same capacity as the Grasbrook works would have required a larger expenditure than the reconstruction of the existing works; and, owing to its less favourable position, it would have involved higher working charges. The Senate of the City took the view, however, that it was unnecessary at the moment to carry out the whole of the extensions at the Grasbrook works, involving the expenditure of £700,000. It was decided to vote a sum of £450,000 for the work of reconstruction to be carried out during the years 1908-09. This sum included the expenditure for the erection of the new gasholder (from which the present catastrophe emanated) and of the coal-store, as well as the greater part of the extension of the mains to the distributing system, but only half the contemplated expenditure on new carbonizing plant and a third of the estimated outlay on the water-gas plant.

Later Details.

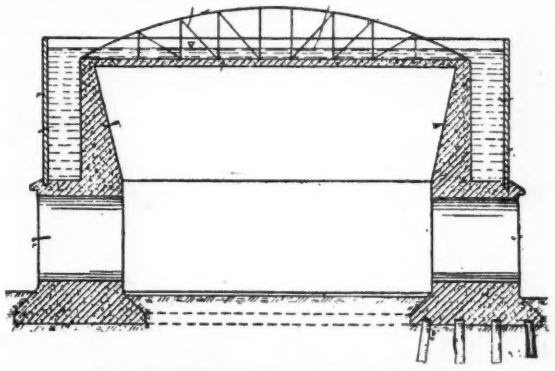
Subsequent reports state that on Wednesday morning the scene of the catastrophe presented a most dismal aspect. Beneath the large gasholder lay, in dire confusion, masses of concrete and masonry, iron girders and bars, and charred planks. It was impossible to remove or explore this *débris* to any considerable extent until struts and props had been erected to support the tank and the plates of the bell, and thereby the risk of further loss of life through the falling-in of the superstructure guarded against. This shoring-up of the tank, &c., and the laying of cables to carry electricity for lighting the ruins, claimed first attention on Wednesday; but it was anticipated that some days would elapse before the substructure could be thoroughly explored and examined. Notwithstanding that the retort-settings did not suffer damage, it is expected that it will be six months before the normal supply of gas from the Grasbrook works can be resumed. Consumers are being asked to limit the use of gas as much as possible for this period; and the public lighting will be restricted. The scene of the disaster was visited on Wednesday by the Burgomaster, Dr. Burchard, and by several members of the Senate of the City and of the Lighting Committee, and a large number of police and other officials.

The gas-works' staff estimate that 3,400,000 cubic feet of gas in the new gasholder and 1,400,000 cubic feet in the old gasholder were burnt; but some estimates make the quantity of gas in the new holder at the time of the outbreak rather larger. The dead include workmen in the employ of a number of contracting firms engaged in the reconstruction of the works, and several women employed in the canteen and kitchen.

Construction of the New Gasholder and Tank.

The new gasholder, of about 7,060,000 cubic feet capacity, in which the disaster had its inception, was erected, as already stated, jointly by the firms of F. A. Neuman, of Eschweiler, and the Berlin-Anhalt Engineering Company, of Moabit, Berlin. The contract appears to have been placed at the beginning of last year; and the autumn of this year was specified as the time for its completion. The contract price was 1,011,500 marks (nearly £50,000). The authorities of the gas-works required the construction to be such that railway lines should run beneath the holder for the passage of waggons; and hence it was necessary that the tank should be of somewhat similar design to that of the gasholder (of half the capacity of that at Hamburg) which was erected some few years ago at the Amsterdam Gas-Works, and of which a full description was given by Heer van Rossum du Chattel at the meeting of the Gas Section of the Engineering Congress at Glasgow in 1901. [See "Journal," Vol. LXXVIII., p. 706.] But, as will appear, some essential differences have been introduced in the Hamburg holder. The firms concerned in the erection of the latter are second to none in repute among constructing engineers for this type of work in Germany. The Berlin-Anhalt Company ("Bamag") are the constructors of the next largest gasholder in Germany—viz., the new one at the Charlottenburg Gas-Works, of 5,300,000 cubic feet capacity. This firm's share in the construction of the Hamburg gasholder was the bell or holder proper, which is in four lifts; while Messrs. Neuman erected the guide-framing and built the tank. The latter firm have recently also been engaged on the new holder, of about 1¾ million cubic feet capacity, having a wrought-iron tank 164 feet in diameter, at the Bremen Gas-Works.

The system of guide-framing adopted in the Hamburg holder is covered by a German patent (No. 152,685) granted to the firm of F. A Neuman, and dated Dec. 6, 1901. This type of framing, which is intended for holders guided either by radial or tangential rollers, or by both these types of rollers, has columns which are of relatively great depth in the radial direction, and the columns are connected in the following manner. The outer angles of every column are connected by diagonal and horizontal rods to the inner angles of the next column. A panel-work is thus formed, the feature of which is that it lies in the same plane extending between the outer faces of alternate columns, which plane is intersected by the inner face of the intervening column. Whether the rods run exactly in the same plane between alternate columns or whether they are bent slightly where they are attached to the inner face of the intermediate column, must depend on the relations maintained between the depths of the columns, their number, and the circumference of the holder. The framing of the new Hamburg gasholder appears to have consisted of 32 columns; while the diameter of the holder was about 250 feet. An impression of the depth of the columns and the general appearance of the guide-framing may be obtained from the view of the holder on p. 733. The holder is stated to be about 200 feet high; so that the depth of each lift and of the tank would be about 50 feet.



The Scheuss Construction of Gasholder Tank.

The tank was, by the contract, to be constructed according to the design patented by Herr M. Scheuss, of Eschweiler, by which the inner wall of an annular tank is formed of a concrete ring. This type of tank has been adopted by the firm of F. A. Neuman for other gasholders—*e.g.*, one at Chemnitz. Apparently, the design is that covered by the English patent, No. 26,078 of 1904 granted to Herr Scheuss [see "Journal," Vol. LXXXIX., p. 714]. According to this patent, an annular gasholder tank is constructed with the inner wall and horizontal bottom of the ring-tank made of masonry, concrete, or reinforced or armoured concrete, while the outer wall of the ring-tank is of iron or steel. When the masonry or concrete base of the ring rests directly on the ground, the area enclosed by the ring is merely made water-tight, and a layer of water, as sealing liquid, covers it. But, when, as in the case of the Hamburg holder, it is desired to have the interior space available for general storage purposes or for the passage of railway waggons, it is best, according to Herr Scheuss, to elevate the annular tank, in order to afford easy access to the interior, and to admit of daylight gaining admission thereto through windows provided in the substructure. The tank at Hamburg, as our view of the holder shows, was mounted on such a masonry or concrete substructure, having arches and windows for the passage of goods and persons and the admission of daylight to the interior. When this type of construction is adopted, a water-tight ceiling is provided above the interior space within the annular tank a short distance below the water-level in the latter, as shown in the annexed figure illustrating the Scheuss construction of a gasholder tank. The water then extends over the ceiling or roof of the interior chamber and seals the whole gas-tight. The ceiling or roof is carried by a framework of girders, which may be made to serve the dual purpose of carrying the ceiling and of supporting the crown of the holder when the bell is grounded. In the Hamburg gasholder, this ceiling or roof was evidently of cement concrete. The tank differed from that of the Amsterdam gasholder essentially in being constructed, as to its base and inner walls, of concrete, reinforced and supported by steel girders where necessary, instead of being like the Amsterdam tank wholly a steel structure. The interior chamber appears to have been utilized at Hamburg in part at least for a canteen and kitchens; and it was traversed by railway lines.

The Cause of the Disaster.

Reports state that it is as yet impossible to assign any cause for the breakdown of the holder, and that until the official inquiry which is to be held shortly has taken place any explanations that are offered must be pure conjectures. Nevertheless, we quote for what they are worth, some of the explanations hazarded in the "Hamburger Nachrichten." According to one account, the second lift of the gasholder was at the time just clearing the tank; and the third lift was beginning to rise. The cupping of this lift increased the pressure within the holder; and the extra pressure sufficed to blow the water seal in the cup, and the escaping gas was fired. It is suggested that the flames issuing from the stacks of the neighbouring retort-houses may have fired the gas; and once it had been fired, the enormous flames cracked the roof of the chamber or vault of the tank, into which the gas then passed. The flames from the burning gas in the vault streaming forth horizontally from the arches, were responsible for much of the subsequent damage and loss of life. This explanation implies either that the cups were too shallow—which from the repute of the constructors may be ruled-out as inconceivable—or that they leaked badly, or else that the third lift jammed, and so caused the pressure to rise to an abnormal amount, or that there was tilting of the upper lifts. Yet the report which suggests that the increased pressure caused by the third lift blew the seal of the cup, states that the holder had been previously raised to its full height, and tested under air-pressure, and that no fault had been observed in this test.

An Early Photograph of One Part of the Large Holder After the Fire.

[The Old Gasholder House referred to in the Article is shown on the Left-Hand Side.]

Another and later report, however, states that a test of the holder under air-pressure had been carried out a fortnight before the date of the disaster, and that it had revealed unsoundness, so that a second test was considered necessary. Whether this second test with air had been made, is not clear. But the authorities are taken to task for having allowed a gasholder which had proved unsound under the air-test to be filled with gas; and an explanation is demanded of this course of action. Clearly, if the report is true, that gas was put into so large a gasholder while by the air-test it was known to be unsound, a most serious responsibility rests upon those who authorized the filling of the holder with gas. But, it would be unfair to attach much importance to these early explanations—especially as it was announced at the official Lighting Bureau of the City, about the same time, that so far it had been absolutely impossible to assign a cause for the accident. Notwithstanding the foregoing conjectures of carelessness or fault on the part of those responsible for the filling of the holder with gas, the local Press, at the same moment, speaks most confidently of the technical ability of the staff at the gas-works.

The Largest Holder.

During the week (writes Mr. F. S. Cripps) all sorts of wild statements have been made as to the size of the Hamburg gasholder which "exploded." It has been described in the "Daily Mail," "Mirror," and other papers as the "World's Largest Gasometer." If you can find space for a note controverting this, it would be as well; for there is no reason for be-littling England, and glorifying Germany, even in the matter of gasholders. The "Mirror" stated the holder to be 200,000 metres capacity, or 7,060,000 cubic feet, which is 71 per cent. less than the 12,000,000 cubic feet holder of the South Metropolitan Gas Company, not to mention the 14,000,000 cubic feet holder in New York, which latter I hope, ere long, England will eclipse.

NEW GAS-WORKS PROPOSED FOR TRIESTE.

In the hall of the Society of Engineers of Trieste, the Engineer of the Municipal gas-works, Sig. Sospisio, recently explained his proposals for new works in the city.

He considered the question whether the day would come when the electric light would supplant gas, and therefore whether the construction of a small gas-works to supplement the existing large ones would be sufficient. His opinion was that electricity would never supersede gas in Trieste; and he gave figures to prove his contention. Having established the point as to the necessity of new works, he next considered three sites which were suggested. Each section of the new works should, he said, be able to produce and deal with 20 million cubic metres of gas per annum—say, 706 million cubic feet; and each section could be divided into two equal parts for a make of 10 million cubic metres. The construction of the first section could be commenced, and progress made with the following sections in accordance with the increase in the consumption. Sig. Sospisio next described his ideal system for unloading coal from vessels; and he illustrated the method by which it could be carried by an aerial electrical railway into the stores and thence to the retorts, and the coke subsequently dealt with. Large mains could be saved by the gas being sent to the distributing gasholder stations in the city at high pressure.

After the explanation of Sig. Sospisio's many designs, Sig. Ing. Pittoni proposed the appointment of a Sub-Committee to study the problem—a proposal that Sig. Sospisio willingly accepted, offering to submit to it all his reports and particulars. The Sub-Committee was thereupon appointed.

FERRO-CONCRETE RESERVOIR AT COWES.

A recent issue of the monthly publication bearing the title of "Ferro-Concrete" contains an illustrated description of a new ferro-concrete covered reservoir for filtered water which has been constructed at Cowes, Isle of Wight. It was formed by dividing and covering over part of an existing storage reservoir; and the covered portion, which has a capacity of 1½ million gallons, is entirely of Hennebique ferro-concrete. The reservoir measures 247 feet long inside, and is divided into two compartments, each 80 feet wide. The mean depth of the reservoir is 16 feet, and the mean depth of water 13 feet. The new division wall consists of vertical panels, 9 inches thick, stiffened by counterforts on both sides, spaced 5 ft. 8 in. apart, centre to centre, and finished with a 9-inch curb flush with the face of the counterforts on the uncovered side of the reservoir. The interior columns, 9 inches square, are disposed in twenty rows, for the most part spaced at intervals of 11 ft. 3 in., centre to centre, each row comprising three columns in the width of 80 feet. With the exception of the outer spans of 22 feet, the main beams measure 19 ft. 4 in. from centre to centre of the columns, and afford support for the secondary beams, which divide the roof into panels measuring 11 ft. 3 in. long by 6 ft. 4 in. wide; the outer panels at each end being 22 feet long. Carried by the main beams, extending from side to side of the reservoir, measuring 7 inches wide by 14 inches deep, the secondary beams are 5 inches wide by 8 inches deep; and the continuous roof slab of ferro-concrete is 4 inches thick. The whole of the works, comprising two sets of Candy filters, pumping machinery, and buildings, were designed for the Cowes Urban District Council by Mr. John W. Webster, their Surveyor and Water Engineer, with the collaboration of Messrs. Mouchel, of Westminster, so far as concerned the details of the ferro-concrete construction, and have cost £5450.

Photography has of late years entered so largely into the domain of journalism, as our pages testify every week, and so many people engaged in the gas industry handle the camera as a recreation, if not for business purposes, that no excuse is needed for calling attention here to the "British Journal Photographic Almanac and Photographer's Daily Companion" for 1910, of which we have just received a copy. It is a bulky volume of rather more than 1300 pages (7 in. by 4¾ in.). The contents include lists of photographic societies and bodies; formulæ for the principal processes and those of the chief plate and paper makers; chemical, exposure, and optical tables, and miscellaneous information. The Editor (Mr. G. E. Brown, F.I.C.) has a chapter on "Lens Calculations by Mental Arithmetic;" and he contributes an "Epitome of Progress." The book is published by Greenwood and Co., 24, Wellington Street, Strand, W.C., at the price of 1s., or bound in cloth, gilt lettered, at 1s. 6d. net.

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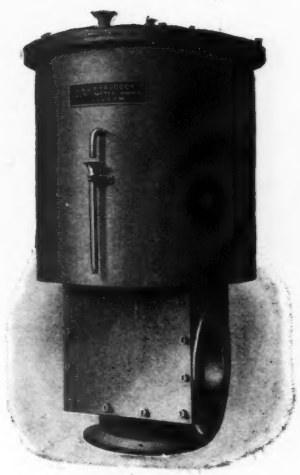

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H. Pattern fitted with Two No. 2 Inverted Burners, Ball Trap Door and Wrought Cradle.

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Fig. 19.

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THE LATEST GAS UNDERTAKINGS RETURNS.

Official Figures as to Gas Supply.

As briefly notified in last week's "JOURNAL," the returns relating to the gas undertakings of the United Kingdom for the year to Dec. 31, 1908, in the case of Companies, and to March 31, 1909, for the Local Authorities, were issued on the 6th inst.—having been ordered for printing on the 4th of November only. Those immediately preceding were published even more promptly; having appeared within a fortnight of the order being given. This, it must be acknowledged, is a great improvement on past years. The number of pages occupied by the Gas Companies' returns is the same as before; but there are four additional pages in those of the Local Authorities.

Information is furnished in reference to 790 undertakings this year, compared with 770 before. The new comers among the 499 Companies are Annfield Plain and District, Brockenhurst, Southwell District, Stanford-le-Hope, and Tenterden and District; and, among the Local Authorities, Arlecdon and Frizington, Ballinasloe, Coleraine, Dalton-in-Furness, Dunoon, Ellon, Grangemouth, Largs, Liverpool, Richmond (Yorks), Sandwich, Monifieth, Newmilns and Greenholm, Sanquhar, and Wath and Bolton (Gas Board). The capital authorized (including other purposes than gas supply in certain cases) is given as £152,702,081, of which £130,708,693 has been paid up and borrowed. For the Local Authorities, the capital authorized is £45,986,570, and the amount borrowed £41,435,988. In the case of the Companies, the figures are: Amount authorized, £106,715,511, being £85,224,944 share and £21,490,567 loan capital; amount paid up and borrowed, £89,272,705. The receipts are: Companies, £20,013,159; Local Authorities, £10,506,480—making a total of £30,519,639.

The statistics relating to working show that 15,394,307 tons of coal were carbonized; the quantity of gas produced being 189,918,737,000 cubic feet, of which 173,957,395,000 cubic feet were sold. The total make includes 21,628,862,000 cubic feet of water gas and 93,500 cubic feet of acetylene gas. The totals in the preceding returns were: Coals, 15,406,753 tons; gas made, 188,486,693,000 cubic feet; gas sold, 172,889,147,000 cubic feet; water gas made, 20,259,883,000 cubic feet; acetylene gas made, 94,080 cubic feet. At the date to which the latest returns were made up, there were 34,490 miles of mains in use to supply 5,916,120 consumers and 700,696 public lamps. The preceding figures were: Miles of mains, 33,536; gas consumers, 5,665,176; public lamps, 700,264.

With regard to carburetted water gas, the make by the Companies has increased from about 13¾ millions in 1904 to 16½ millions at the close of last year; the production by the Local Authorities having in the period from 1904-5 to the close of the year ended March 31 remained practically stationary—the figures being 5,033,643,000 and 5,072,976,000 cubic feet respectively. The returns show that when they were made up it was being supplied by the following Companies and Local Authorities; the maximum proportions of its admixture with coal gas (except where averages are stated) being given in parentheses.

Companies.

Alliance and Dublin (49.)
Aylesbury (15).
Barking (30).
Bath (50).
Bexhill (29·43).
Bish. Stortford (40·87).
Bognor (30).
Bournemouth (36).
Brentford (33).
Bridgwater (33½, aver. 13).
Bridlington (33).
Brighton (41·72).
Bromsgrove (30).
Cardiff (20 to 30).
Chigwell (33).
Cleethorpes (26).
Colchester (27).
Commercial (43·23).
Croydon (37·9, av. 29·1).
Dartford (22).
Dorking (25).
Durham (20 estimated).
Eastbourne (41).
Epsom (31·5).
Falmouth (20).
Folkestone (33½).
Gaslight and Coke (*).
Gosport (33, av. 9·5).
Gravesend (45).
Guildford (25 to 33½).
Hampton Court (40).
Harrow (41 calc. over one week).
Hartlepool (abt. 20, av. 16).
Hastings (39·84†).
Hornsey (av. 32).
Horsham (33).
Hull—British (32).
Hythe and Sandgate (40).
Ilford (25·8).
Ilfracombe (10·2).
Ipswich (24).
Kingston-on-Thames (25).
Liverpool (50).
Lea Bridge (44).
Londonderry (15, av. 10).
Maidenhead (48).
Maidstone (25).
Malton (about 27).
Marlborough (30).
Merthyr Tydfil (22¾).
Mitcham (39).
Newcastle (7·76 one wk.).
Newport, Mon. (22).
North Middlesex (52·72).
Norwich—British (43·6).
Nuneaton (9).
Plymouth (42).
Portsea Island (30·9).
Prescot (29·28).
Preston (40·5, av. for one week).
Ramsbottom (25).
Reading (39·4).
Redhill (29).
Rochester (33).
Romford (35).
Rushden and Higham Ferrers (16·89, av. 10·85).
St. Albans (30).
Scarborough (26).
Southampton (34).
Southend (52·3).
Southgate & District (61).
South Shields (22·97 on one day only).
Staines and Egham (25).
Stretford (27·44).
Swansea (25, av. 20).
Swindon United (36).
Taunton (35).
Tonbridge (25).
Torquay (42·6, av. 32·2).
Tottenham (‡).
Truro (40).
Tunbridge Wells (25 to 30)
Uxbridge (27).
Waltham Abbey (2·4).
Wandsworth (42·2, aver. 28·5).
Watford (33·5).
West Ham (35·55).
Weston-super-Mare (33).
Wexford (25).
Winchester (39).
Wolverhampton (not stated).
York (25·08).

*Of the total quantity of gas sent out by the Company, 11 per cent. was unmixed with water gas. As regards the remainder, 68 per cent. contained a maximum proportion of 29 per cent. of carburetted water gas; 12 per cent., a maximum proportion of 36 per cent.; 12 per cent., a maximum proportion of 39 per cent.; and 8 per cent., a maximum proportion of 40 per cent. † Average for the year, 27·46 per cent. ‡ Maximum daily proportion, 51 per cent.; average, 33 per cent.

Local Authorities.

Accrington (25).
Ashford (26·1, av. 16·2).
Barrow-in-Furness (20·23).
Belfast (52).
Birkenhead (33·33).
Birmingham (25).
Blackburn (19).
Burnley (34).
Carlisle (28·1).
Chorley (25).
Coventry (29·08).
Devizes (42).
Devonport (51·6).
Dundee (25).
Edinburgh (4·3).
Halifax (25·22 one day only).
Hebden Bridge (25).
Leeds (25).
Leigh (15).
Lincoln (33·33*).
Longton (about 30).
Loughborough (25).
Manchester (20·14 on the total output).
Middlesbrough (no limit).
Nottingham (6·28).
Oldbury (20).
Oldham (38†).
Paisley (1·67 oil gas).
Pontypridd (39·3).
Rochdale (25).
Smethwick (20).
Southport (39·98).
Stafford (12).
Stockport (25).
Stockton-on-Tees (21).
Tipton (0·7).
Todmorden (18·5).
West Bromwich (29·5).
Wigan (10).

* In the daytime; none at night. † At one station only, and on one day only.

Six new Companies appear in this list: Bromsgrove, Cardiff St. Albans, South Shields, Torquay, and Wolverhampton; and the Bilston and Faversham Companies drop out. No additional Local Authorities furnish returns; and those of Leicester and Nelson drop out.

As in previous returns, particulars are furnished regarding the nature and quantity of materials other than coal used for the manufacture of gas. The extent to which oil, petroleum spirit, carburine, or "other material" is being utilized will be seen from the following list of companies and local authorities who make returns:—

Companies.

Alliance and Dublin.
Alton.
Aylesbury.
Barking.
Bath.
Bexhill.
Bishop's Stortford.
Bognor.
Boston.
Bournemouth.
Brentford.
Bridgwater.
Bridlington.
Brighton and Hove.
Bristol.
Broadstairs.
Bromsgrove.
Bude.
Canterbury.
Cardiff.
Chigwell.
Cleethorpes.
Coatbridge.
Colchester.
Commercial.
Croydon.
Dartford.
Derby.
Dorking.
Dover.
Durham.
Eastbourne.
Epsom and Ewell.
Exeter.
Falmouth.
Fareham.
Folkestone.
Gaslight and Coke.
Gosport.
Grantham.
Gravesend.
Guildford.
Hampton Court.
Harrow and Stanmore.
Hartlepool.
Hastings.
Hornsey.
Horsham.
Hull (British Co.).
Huyton and Roby.
Hythe and Sandgate.
Ilford.
Ilfracombe.
Ipswich.
Isle of Thanet.
Kingston-on-Thames.
Lea Bridge.
Littleborough.
Liverpool.
Londonderry.
Maidenhead.
Maidstone.
Malton.
Marlborough.
Merthyr Tydfil.
Mitcham and Wimbledon.
Newcastle-upon-Tyne.
Newport (Mon.).
Northfleet.
North Middlesex.
Norwich (British Co.).
Nuneaton.
Plymouth.
Portsea Island.
Prescot.
Preston.
Quorndon and Mountsorrel.
Ramsbottom.
Reading.
Redhill.
Rhymney and Aber Valleys.
Richmond.
Rochester.
Romford.
St. Albans.
Scarborough.
Shrewsbury.
Southampton.
Southend.
Southgate and District.
South Shields.
Staines and Egham.
Stirling.
Stretford.
Sutton and Hooton.
Swansea.
Swindon.
Taunton.
Tonbridge.
Torquay.
Tottenham.
Truro.
Tunbridge Wells.
Tynemouth.
Uxbridge.
Waltham Abbey and Cheshunt.
Wandsworth and Putney.
Watford.
West Ham.
Weston-super-Mare.
Wexford.
Winchester.
York.

Local Authorities.

Abergavenny.
Accrington.
Airdrie.
Alloa.
Alva.
Arbroath.
Ashburton.
Ashford.
Ballinasloe.
Barrow-in-Furness.
Belfast.
Birkenhead.
Birmingham.
Blackburn.
Blackpool.
Burnley.
Bury.
Carlisle.
Chorley.
Coventry.
Darlington.
Dalton-in-Furness.
Darwen.
Devizes.
Devonport.
Dumfries.
Dundee.
Dunfermline.
Edinburgh and Leith.
Ellon (oil gas only).
Glastonbury.
Greenock.
Halifax.
Hebden Bridge.
Helensburgh.
Heywood.
Hamilton.
Ilkeston.
Leeds.
Leek.
Leigh.
Lincoln.
Llandudno
Longton.
Loughborough.
Manchester.
Market Harborough.
Middlesbrough.
Middleton.
Mossley.
Nottingham.
Oldbury.
Oldham.
Oswaldtwistle.
Paisley.
Perth.
Pontypridd.
Portsoy (acetylene gas only).
Rochdale.
St. Helens.
Smethwick.
Southport.
Stafford.
Stratford-on-Avon.
Stockport.
Stockton-on-Tees.
Tipton.
Todmorden.
Torquay (St. Mary Ch.).
Walsall.
Warrington.
West Bromwich.
Wigan.

The new names in the above lists are the Boston, Bromsgrove, Bude, Cardiff, Fareham, Hythe and Sandgate, Ilfracombe, Nuneaton, Rhymney and Aber Valleys, St. Albans, South Shields, Stirling, Sutton and Hooton, and Torquay Companies; and the Faversham and Rushden and Higham Ferrers Companies drop out. Seven new Local Authorities make returns: Abergavenny, Ballinasloe, Dalton-in-Furness, Ellon, Hamilton, Market Harborough, and Oswaldtwistle. On the other hand, the following names which were in the preceding list do not now appear: Abertillery, Leicester, Nelson, and Stalybridge.

The Gas Commissioners of Portsoy used 10 tons of carbide of calcium in the manufacture of 93,530 cubic feet of acetylene gas, of which 61,229 cubic feet were employed for private and 23,392

cubic feet for public lighting—together 84,621 cubic feet, at the price of 5s. per 100 cubic feet.

Comparing the figures furnished by the present returns with those contained in similar returns for the previous nine years, it will be seen that the Companies show as follows:—

Year.	Share and Premium Capital Paid Up.	Loan Capital Issued.	Receipts.	Expenditure.
1899. . .	£57,937,016	£11,451,134	£15,514,700	£11,478,442
1900. . .	59,638,877	11,775,642	17,638,963	13,864,808
1901. . .	62,775,845	12,201,533	17,955,187	14,537,797
1902. . .	64,299,112	12,829,925	17,205,002	13,167,186
1903. . .	67,417,798	13,451,381	17,756,626	13,214,322
1904. . .	68,953,306	13,775,734	17,828,872	13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1899. . .	8,321,187	91,794,898,282	1,817,649	324,166
1900. . .	8,426,853	94,869,749,232	1,945,825	326,813
1901. . .	8,580,365	97,386,618,553	2,048,359	326,209
1902. . .	8,520,004	99,676,048,000	2,197,987	333,308
1903. . .	8,528,823	101,490,084,000	2,385,348	335,363
1904. . .	8,673,343	105,311,980,000	2,588,917	343,908
1905. . .	8,722,145	109,823,682,000	2,813,156	350,113
1906. . .	8,922,781	114,528,923,000	3,023,619	356,070
1907. . .	9,240,280	118,699,705,000	3,230,993	362,986
1908. . .	9,281,738	119,985,109,000*	3,399,193	367,950

* Including 16,555,886,030 cubic feet of water gas. Number of cubic feet sold, 109,316,716,000.

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1899-00 .	£29,658,730	£8,048,089	£6,155,725	£1,280,168	£663,189
1900-01 .	31,509,701	9,121,418	7,463,693	1,353,259	409,802
1901-02 .	34,045,442	9,300,567	7,630,856	1,467,232	414,091
1902-03 .	35,738,023	9,554,984	7,215,502	1,584,985	793,764
1903-04 .	37,103,279	9,819,685	7,182,008	1,700,405	967,194
1904-05 .	38,512,295	9,546,682	7,052,474	1,738,682	790,450
1905-06 .	39,401,896	9,636,107	7,085,710	1,799,094	798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341
1907-08 .	40,712,159	10,500,416	7,839,122	1,882,427	827,454
1908-09 .	41,435,988	10,506,480	7,998,776	1,905,810	659,445

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1899-00. .	5,289,501	55,360,659,139	1,667,908	257,040
1900-01. .	5,479,435	57,138,062,255	1,767,464	278,343
1901-02. .	5,522,264	59,300,273,086	1,872,633	287,887
1902-03. .	5,589,215	60,902,739,000	1,970,738	294,828
1903-04. .	5,673,013	62,717,759,000	1,945,777	301,308
1904-05. .	5,622,259	63,335,696,000	2,148,260	310,275
1905-06. .	5,758,180	65,081,109,000	2,250,919	315,678
1906-07. .	5,923,476	67,312,153,000	2,339,914	321,910
1907-08. .	6,166,473	69,786,988,000	2,434,183	327,278
1908-09. .	6,112,569	69,933,629,000*	2,516,927	332,746

* Including 5,772,976,000 cubic feet of water gas and 93,530 cubic feet of acetylene gas. Number of cubic feet consumed, 64,640,679,000.

New Gas-Works at Innsbruck.

At the end of the month of October, new gas-works, of a productive capacity of 530,000 cubic feet per diem, were brought into operation at Innsbruck, and have worked quite satisfactorily up to the present time. The principal novel feature of the works is that the whole carbonizing plant consists of horizontal chambers or ovens, 16·4 feet in length, erected by the firm of H. Koppers, of Essen. There are no tar or liquor wells, and the products of condensation are collected and stored in iron tanks, standing in the open, which can be heated. The tar and liquor can for the most part be run directly out of these, and only a small amount has to be pumped out. The design and plans of the new works were drawn up by Herr O. Peischer, the Manager of the gas undertaking; and the plant and apparatus were supplied by a number of German and Austrian firms.

Sir William Stephenson, the Lord Mayor of Newcastle, who is Chairman of the Newcastle and Gateshead Gas Company, has, for the tenth consecutive time, been unanimously chosen as Chairman of the Tyne Improvement Commissioners.

FURTHER EXPERIENCES WITH HEAVY CHARGES

By G. M. Gill.

This article is intended to deal more fully with some of the points raised in a previous article on the same subject, published in the "Journal" for Oct. 12 (p. 103), and also to reply to the editorial suggestion that some further particulars were desirable. These particulars were omitted, owing to the writer having insufficient data on which to form his conclusions.

Make per Mouthpiece.

At first sight, it would seem strange that the adoption of heavy charges should render it possible to increase the quantity of coal carbonized per twenty-four hours; and the writer is aware that certain engineers have not found any increase in this respect to result from the use of heavier charges. Mr. J. Ferguson Bell, in his admirable paper on "Carbonizing" read at the last meeting of the Institution of Gas Engineers, clearly shows that the quantity of coal carbonized is in his case reduced, if anything, rather than increased. The writer cannot quite understand why this should be so, as it appears to him that the larger area of the retort that is filled with coal in the case of the heavy charge should surely make use of the heating surface to much greater advantage. That this should be so would seem to the writer to depend on the law of the radiation of heat, which, as readers of the "Journal" know, is governed by the same law as that of light—*i.e.*, the intensity of heat or light varies inversely as the square of the distance from the source of the heat or light. In the case of a retort charged with coal to the extent of from one-half to two-thirds of the capacity of the retort, there is left a considerable space at the top in which the radiating heat from the upper surface of the retort is fruitlessly expended before reaching the top layer of the charge. This space merely forms an area in which this law is given full play to waste the radiant effect of the heating gases.

In this connection, it is interesting to notice that Mr. Samuel Carpenter, of Dorking, states that, with the circular retort fully charged with coal, he is able to carbonize this quantity in a period of time which is only 15 per cent. greater than when the retort is only filled to the extent of half its capacity. This bears out the writer's experience with filled-up retorts, but to a much greater extent. This extraordinary result is apparently attributed to the uniformity with which the coal is heated, and the way in which the heat is distributed equally on all sides to the centre of the charge. This is a noteworthy fact; and should Mr. Carpenter's experience be borne out by that of others, the circular retort would probably again come into general use, ousting the ⊏ retort from its present popularity.

Size of Retort.

There are plainly limitations to the size of the retort used with full charges; and the reason for this is clearly shown by some figures, on the penetration of heat, given by Mr. Thomas Glover in his Presidential Address to the Institution of Gas Engineers. It will be remembered that he gives figures to show that carbonization proceeds more rapidly with narrow than with wide ovens. In the case of ovens 12 inches wide, he states that carbonization proceeds at an average rate of 0·500 inch per hour from each side; with ovens 16 inches wide, at the rate of 0·470 inch; with ovens 17 inches wide, at the rate of 0·425 inch; while with ovens 20¾ inches wide, carbonization only proceeds at the rate of 0·305 inch per hour from each side. This being so, it is not difficult to understand why coke-ovens compare badly with retorts in respect of output of gas per cubic foot of area.

If the section of a heavy charge be closely observed during the process of carbonization, it will be seen that the outer surface of the coal is comparatively quickly carbonized, while the inner core would appear to need a proportionately large amount of heat to drive off its gaseous contents. As a result of this, it is obvious that, were this core increased in size by reason of the retort being of larger area, this tendency would become greatly accentuated. It would, therefore, seem desirable that the most serviceable size of retort, of whatever shape, should be determined by practical experience.

Make per Ton.

With regard to the questions propounded in the Editorial previously referred to, the class of coal in use can best be described as Durham coal of medium quality; several varieties being used. But these same varieties were in use during the period when charges of short duration were in vogue. Further, the effect of heavy charges in increasing the carbonizing capacity of the retorts would undoubtedly apply to all classes of coals. Unfortunately, it is difficult to compare the make of gas per ton obtained with the different duration of charges, as estimates of the amount of coal used in any definite time are largely dependent upon the accuracy with which the coal stocks are calculated. It is always a difficult matter to arrive at the quantity of coal used in any fixed period, except in isolated cases where there is no intermediate stage between the weighing and the use of the coal, or where the storage (after weighing) is of limited extent. For the reason stated, no figures can be given with any confidence in their reliability; but it may safely be asserted that, with heavy charges of ten or twelve hours' duration, it is possible to considerably

increase the make of gas per ton of coal, as compared with the shorter period of six hours. This increase might approximate to about 500 cubic feet per ton of coal.

Some who have experience in this matter might attribute an even greater improvement in this respect, comparing the new with the old method; but universal opinion would seem to agree that the improvement is at any rate substantial. The question naturally arises as to the reason of there being an increase in the amount of gas produced per ton, especially when the appearance of the burnt-off charges under the six-hour system is compared with that of the charges under the longer period.

Illuminating Power.

The writer's opinion inclines to the belief that the quality, as measured by candle power, is lower when using heavy charges. This is certainly his experience. While working with six and eight hour charges, the average illuminating power of the coal gas was 16·6 candles for a period of eight months during which the six-hour and eight-hour systems were each in force about four months. Since instituting heavy charges, the illuminating power has dropped to an average of 15·5 candles. Before proceeding further, it should be explained that the tests in question were regularly taken every half-hour on a jet photometer, which was carefully adjusted once or twice every day with a table photometer in which the Carpenter burner was used. To supplement these figures, it may be stated that one or two tests have been taken daily on coal gas with the table photometer; and it is interesting to record that the average was 16·6 when working six and eight hour charges, as compared with 15·7 under the longer system. It is not suggested that these figures are in any way conclusive; but they do at least show the tendency which practical experience may be expected to confirm. It may now be asked why should a system of heavy charges and prolonged duration produce a gas of lower illuminating power. The writer has seen it suggested that this is due to the use of an increased vacuum in the retort-house with a corresponding increase of the nitrogen in the gas. This is the gist of a statement made by Dr. Davidson, the Chief Chemist to the Birmingham Gas Department, in a lecture on the "Modern Development of the Gas Industry" published in the "Journal" for Oct. 26, in explaining the "erroneous idea," as Dr. Davidson puts it, that heavy charges give a larger yield of gas per ton of coal. If it be as the learned Doctor enlightens us, a great many are indeed living in a fool's paradise. Does Dr. Davidson suggest that the whole or only part of the increase in the make per ton is due to the increased percentage of nitrogen or other diluents? Those who have tried filled-up charges on a practical scale will certainly rest contented that a system which has met with unanimous favour wherever adopted does not owe its success to the abuse of exhausters. It has already been remarked that with heavy charges the candle power is lower while the make per ton is higher; and the former is doubtless due to the effect of the latter.

Effect of Heavy Charges on Quantity and Quality.

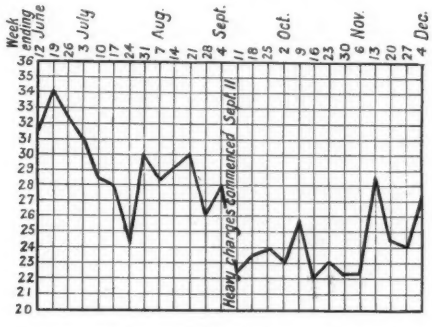
The increased quantity of gas gained by this method would seem to be due to the very thorough carbonization of a large part of the charge, represented by the mass which lies nearest to the retort throughout its entire internal surface. This proportion of the charge would amount to a large fraction (say, fully 75 per cent.) of the whole. The appearance of a charge after some six hours of its carbonization was remarked upon earlier in this article; and it is conceivable that coal, if it is heated for a prolonged period, as is the outer area of a heavy charge, will yield considerably more gas than the 11,000 to 12,000 cubic feet to which we are accustomed in practical working.

With a six-hour charge, none of the coal, or at any rate only a very small portion, would be exposed to prolonged heating, as in this case the coal, lying in a comparatively thin layer, contains no core to which the heat has any difficulty in penetrating, and, consequently, the carbonization takes place more uniformly and rapidly throughout its entire area. It may be questioned whether the extra gas obtained in this manner is worth having; and in this connection it is desirable to ascertain its composition. It would, presumably, consist chiefly of hydrogen, with a small quantity of methane, carbon monoxide, and the usual diluents. Its candle power would undoubtedly be very low—probably not more than two or three candles. Its calorific power, however, would possibly amount to a figure not so far deficient of hydrogen itself—viz., 82·8 calories (gross) per cubic foot.

Bearing upon this point, Mr. Ferguson Bell gives some figures in his paper on "Carbonizing," which help us to appreciate the quality of gas evolved from an apparently spent charge, which would closely resemble the additional gas yielded by a heavy charge. In his Appendix I., he gave the quantity and quality of gas produced each half-hour from a number of retorts charged for eight hours. After the eight hours had elapsed, a few further tests were carried out, which showed that the gas coming away in the succeeding hour averaged 4½ candles and 68 calories (gross), and at the end of the hour was still 2 candles and 52 calories. The writer suggests that it is this quality of gas to which the increased make per ton with heavy charges is due. It is, after all, obvious that, where coal is carbonized in bulk, if the inner core is to be thoroughly carbonized the outer layer must be over-carbonized, with the natural result that the low-grade gas from the over-carbonized coal must mix with, and impoverish to a certain extent, the remaining gas.

Sulphur Compounds.

A further advantage in the use of heavy charges lies in the fact that one of the impurities in coal gas, and one which it is desirable should be reduced—namely, the sulphur compounds—shows a distinct tendency to diminish in quantity. This is very clearly shown by the accompanying diagram, giving weekly aver-



Sulphur Compounds (Grains)—Weekly Averages in a Mixed Gas containing a Uniform Pecentage of Coal Gas and Carburetted Water Gas.

ages of the sulphur compounds in mixed gas containing an almost uniform quantity of 30 per cent. of carburetted water gas. But for the amount of the latter gas contained in the mixture, the average would, of course, be higher by about 10 grains. According to Professor Lewes, the higher the temperature used in carbonization the greater is the production of sulphur compounds other than sulphuretted hydrogen. With light or heavy charges, the temperature of the retorts is apparently the same; but the amount of sulphur compounds contained in the gas is decidedly lower. So that the reduction in this case must be attributed to some other cause than that of temperature. Probably the sulphur vapour as evolved from the coal does not come into contact with the carbon on the retort to the same extent with heavy as with light charges, by reason of the retort being entirely filled with coal, and so is more inclined to combine with hydrogen to form sulphuretted hydrogen.

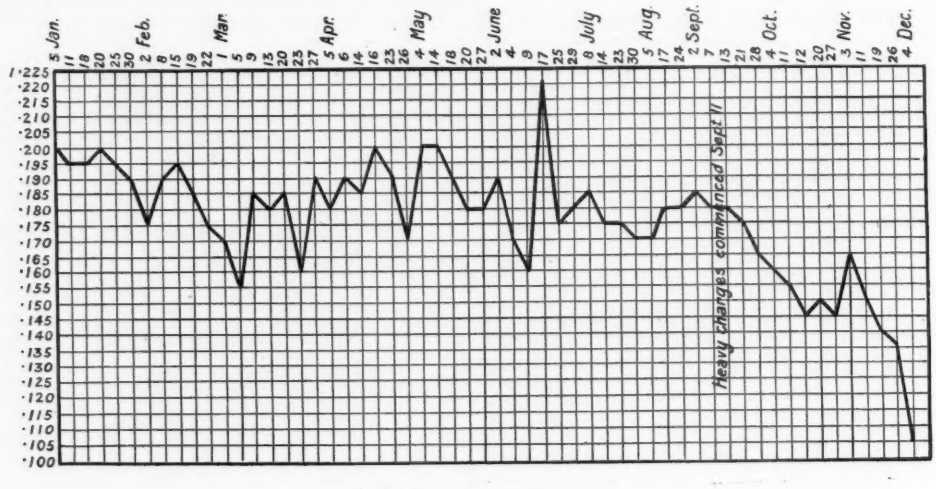
Quantity of Ammonia.

There is no questioning the fact that the yield of ammonia is considerably augmented by increasing the weight of the charges. This experience appears to be universal among those who have adopted this system. Mr. Ferguson Bell attributes an increase of 17 per cent. in the yield of ammonia to the use of twelve-hour charges as compared with six-hour; but it is noticed from his figures that the bulk of the improvement—namely, 13 per cent.—was experienced in the comparatively small alteration from six-hour to eight-hour charges. The writer would, however, add that he has found considerable improvement in increasing the charges from eight hours to ten-and-a-half hours. The extent of the improvement is somewhat difficult to judge; but it would appear to be of about the same amount as that of Mr. Bell's. From the published figures of a number of gas companies making coal gas only, it may be seen that ammonia yields about 1·87d. per 1000 cubic feet sold; so that, should the adoption of heavy charges result in an increased production to that named by Mr. Bell, the improvement in residual returns will amount to about 0·30d. per 1000 cubic feet sold. This is certainly one of the greatest of the many advantages of heavy charges, as the anticipated improvement, as measured in "£ s. d.," is considerable; the impurity is easily removed, and in most cases without any extra expense, or extension of plant; and the bye-product itself, in the form of sulphate of ammonia, is remuneratively sold.

Quality of Tar.

Not least of the benefits resulting from the carbonization of filled-up retort charges lies in the fluidity of the tar produced. The tar from heavy charges is distinctly thinner than that from light charges; and the advantages accruing thereto render retort-house work much freer from the troubles of stopped pipes and pitched hydraulic mains. None but those who have experienced them can realize the intolerable state into which a retort-house can degenerate when carbonizing a coal whose tar is really thick; and it is a very great boon that a system can be adopted whereby the cause of the trouble—*i.e.*, thick tar—may be removed. From the accompanying diagram,* it may be observed that the introduction of heavy charges immediately resulted in the production of a thinner tar, as represented by tests of the specific gravity of the tar as dispatched from the works in barges. The fluidity of the tar not only greatly facilitates the gas-making operations, resulting in a saving of gas from the ease with which it flows away through ascension pipes and hydraulic mains, but it must also be of materially greater value for distilling purposes. Lunge has stated that "in most cases the specific gravity of tar, after dehydration, is a sufficient guide as to its quality." And, further, he states (mentioning Köhler as his authority) that the specific gravity of tar mainly

* See next page.



Specific Gravity of Coal Gas Tar.
[Each division represents the tar from 1000 tons of coal.]

depends upon the percentage of free carbon, as shown in the following table:

Origin of Tar.	Specific Gravity.	Free Carbon. Per Cent.
Heidelberg	1·220	23·75
Darmstadt	1·215	20·93
Baden-Baden	1·195	19·92
Bockenheim	1·190	18·24
Frankfort	1·180	15·70
Bamberg	1·175	15·15
Neustadt	1·172	15·07
Cannstadt	1·164	14·05
Rottweil	1·161	14·00
Karlsruhe	1·155	13·50
Ulm	1·150	12·44
Heilbronn	1·150	12·42
Oos	1·145	5·00

In discussing the question of "free carbon" contents, Lunge explains that "the more free carbon, the more viscous the tar, and the more easily will it froth over during distillation. Tars containing less free carbon—that is, of less specific gravity—are richer in benzene and other light hydrocarbons than those containing more free carbon. But this holds good only to a certain limit—say, 15 or 17 per cent. of free carbon. Above this, tars of equal percentage of free carbon may furnish more anthracene or more benzene, &c., according to their origin. But if they contain considerably more carbon than 17 per cent., they are sure to yield less valuable products of all kinds and more pitch." And, again, he states that tar containing much free carbon is not very saleable, owing to the difficulty of distilling it down to hard pitch, and so injuring the stills. It may, therefore, be safely asserted that the tar produced in working heavy charges is, by reason of its undoubted lower specific gravity, more valuable and saleable.

Mr. Ferguson Bell, further, shows that the production of tar per ton of coal is increased from the respectable yield of 10·64 gallons with six-hour charges to 12·84 gallons with twelve-hour charges—equivalent to an increase of over 20 per cent. The writer has no figures of value with which to endorse those of Mr. Bell; but he has reason to believe, from his own observations, that a material increase in the yield of tar will result from the adoption of fully-charged retorts. It would seem as though all the advantages of low-temperature carbonization in the matter of yield of tar and ammonia are gained with heavy charges, but without the counteracting disadvantage of a low yield of gas per ton.

Naphthalene.

The writer has been disappointed to find that the amount of naphthalene contained in the gas has not, as was anticipated, been reduced by working fully-charged retorts. There would appear to be no difference comparing small with large charges. Others have found an improvement in this respect; but the writer still finds that the coal gas contains an average of some 21 grains of naphthalene per 100 cubic feet at the inlet of the extractor. The bulk is, however, easily removed by the simple medium of washing with carburetted water-gas tar.

Growth of Carbon.

In the writer's previous article, already referred to, it is stated that the use of full charges should tend to prevent the adhesion of scurf by scraping it off when the charge is expelled, but that this point was not as yet demonstrated. His further experience shows that this anticipation is not likely to be realized, as the small space in the retort above the charge of coal scurfs over very rapidly, and has to be frequently chipped away if the retort is to be fully charged. Probably the amount of scurf actually made is not so great with heavy charges as with light ones; but its production is chiefly confined to the top of the retort.

Size of Mouthpiece.

There is one point in connection with the construction of retort settings intended to be worked with heavy charges which should be mentioned, and that is the size of the mouthpiece. The writer has no hesitation in asserting that the iron mouthpiece should be larger than the retort, as the latter wears away slightly at the point where it is bolted to the mouthpiece, leaving a ridge which greatly tends to prevent the easy discharge of the coke. In cases where a charge is jammed during removal, it can usually be traced to part of the mouthpiece projecting at this point. This at least is the experience of the writer. By allowing (say) ¼-inch all round, there would be no danger of jamming due to this cause.

In conclusion, the writer wishes to make it clear that many of the points raised in this article are to an extent matters of surmise, which may, or may not, be confirmed by more extended experience. Again, further experience in practical working will probably disclose improved methods of gaining the utmost advantage from this new system of carbonization.

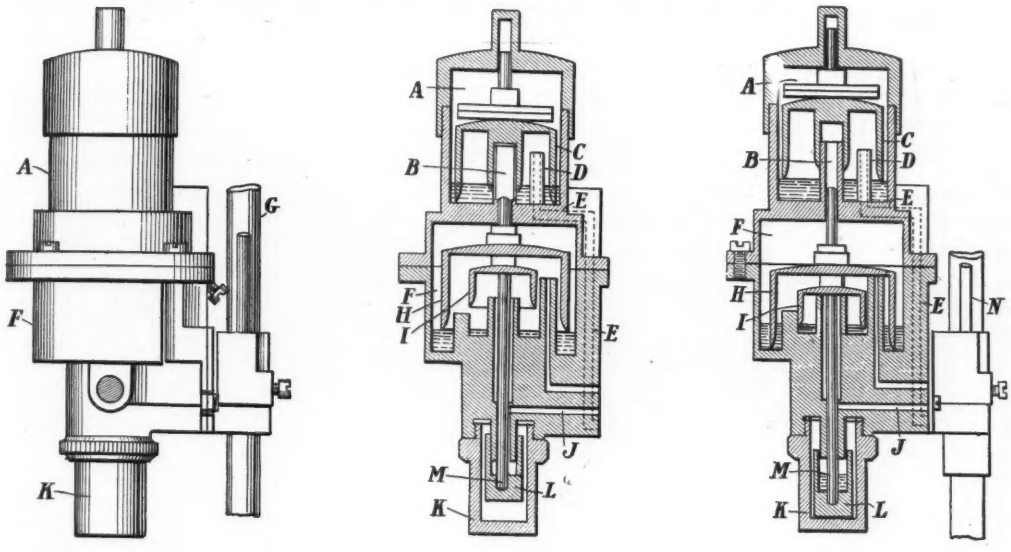
AUTOMATIC LIGHTING OF PUBLIC LAMPS.

The attention that has recently been given to this subject seems to show that the ideal apparatus has not yet been introduced. There are various types—such as the pressure wave system, the clockwork system, and combinations of both of these; and one would expect that the prime factor in any system would be certainty in action. In this respect, perhaps, the clockwork system has some advantage over other systems in vogue; but its initial cost is so much greater than the pressure wave device that attention has naturally been given to improving it, or overcoming defects that have shown themselves in pressure wave devices.

One of the primary disadvantages of the pressure wave device is that the same pressure is employed to light up as to extinguish. As the pressure wave under various conditions of distribution may at times be interfered with, and its full effect not reach the ultimate destination intended, failure to light all the lamps inevitably occurs. A repetition of the pressure wave from the centre of supply might have the effect of lighting the lamps that have not previously been lighted; but it would just as certainly extinguish those that had been lighted. Thus while the pressure wave system has been applied to small districts, and on areas where the pressure is known to be uniform and the conditions well understood, it has not yet been applied indiscriminately with districts subjected to varying conditions.

To overcome the manifest defects in the pressure wave type of apparatus at present on the market, the device introduced and patented by Messrs. Rosie and M'Kelvie, of Edinburgh, and of which to-day we give some particulars, is certainly one to be carefully studied. It possesses many important features of a novel character, and is capable of being manipulated like the ordinary pressure wave devices. It is, however, claimed to be much more positive in action, for the reason that a different (and greater) pressure is employed to extinguish the lamps than is employed to light them. Consequently, the pressure wave sent forward to light up can be repeated as many times as may be thought necessary without in any way affecting the lamps that were lit by the first impression. On the other hand, to extinguish the lamps, a pressure superior to the maximum required for lighting must be employed. There is no practical disadvantage in increasing the pressure wave—particularly during the early hours of the morning, when the minimum consumption takes place.

The apparatus is already on trial in Edinburgh and some other



Scottish towns, and no doubt more will be heard of its utility in the near future.

In the "JOURNAL" for April 13 last, some particulars were given of the arrangement described in Messrs. Rosie and M'Kelvie's patent specification, No. 5793, dated March 16, 1908; and below are some extracts from their later specification—No. 4283, dated Feb. 22, 1909.

In generally referring to their proposals, the patentees say: "Hitherto it has been usual to effect the automatic cutting off of the supply of gas to the gas-burner by decreasing the pressure in the mains, and so that a dome or domes of a gasholder or diaphragm, and any other similar appliance, actuated by increased pressure of gas, falls when the supporting pressure is reduced, and either effects the closing of a mercurial or liquid seal or other valve, whereby the supply to the burner is cut off. One of the objections to this class of apparatus is that the domes, diaphragm, or the like, require to be of sufficient weight to fall by gravitation and overcome the density of their seal. Therefore a fairly high pressure is required to initially lift the dome or the like; so much so that a very little working surplus pressure is left from the available pressure."

The improved method of automatically lighting and extinguishing gas lights now to be described consists in equalizing the pressure of gas on the inside and outside of the operated domes, so as to put them in a state of equilibrium, whereby they fall by gravity and effect the cutting-off of the supply of gas to the burner. Also the gas used to equalize the pressure is momentarily exhausted from the upper portion of the dome chamber and causes a jet of gas from a pilot tube to impinge upon spongy platinum, so as to effect the lighting of the burner. Alternatively, the lengthened jet of the pilot light may be utilized as a flash light to a burner, or across the top of an incandescent mantle,

An important feature in the arrangement is that for both the operations of extinguishing and lighting of gases, frequent waves of pressure can be used without throwing the appliances out of "tune." That is to say, if certain of the lamps do not light for some particular reason in one of the districts when the first wave of pressure is applied, the wave of increased pressure is applied as often as may be necessary without extinguishing the lamps already lighted, until all the gases are lighted. In former apparatus, in which the gas acts on a bell which determines by a raising action the supply of gas to the burner, the gas cannot be increased in pressure so as to cause the lighting without throwing the whole system out of "tune;" and if the gas pressure be reduced to put in order one district of lights, the lights of the other district are extinguished by reason of the operative bell of the appliance falling and cutting off the supply of gas to the burner.

The illustrations show an elevation of the appliance, and longitudinal sections in the operative and inoperative positions.

The chamber A (the "auxiliary chamber") has within it a central stand-pipe B, which is covered by an inverted cup preferably formed along with the bell C. Also within the chamber is a pipe D, also enclosed within the bell C. This pipe has a port or passage communicating with the gas supply pipe E, as shown in dotted lines in the sections.

The central stand pipe B communicates with the chamber F; and the bell C of the auxiliary chamber is so weighted that it takes more pressure of gas to lift it than it does to lift the bell which supplies the gas to the burner-pipe G.

Within the chamber F is a bell H, having a rising and falling action and having within it an inverted cup I. Within the chamber is also a central stand pipe having a port communicating with the gas supply pipe E through the medium of the port J; and to the one side of the stand pipe is a pipe with the port communicating with the burner-pipe G. At the bottom of the chamber F is another chamber K employed for the purpose of effecting the lighting and extinguishing of the pilot light, as will be described later.

The action of the appliance is as follows: Gas enters by the pipe E and passes to the port J; thence up the stand pipe, and impinges upon the confined internal area of the bell H. The gas lifts the inverted cup and bell sufficiently far to clear their liquid seal, and allow the gas to escape to within the interior of the enlarged area of the bell H. The gas passes therefrom down to the burner-pipe G. The same pressure of gas passes to within the interior of the bell C—that is to say, the gas passes from the supply pipe E to the interior of the bell C; but it does not actuate it, because it is weighted so that it takes more pressure to lift it than it does the bell and cup of the chamber F.

The apparatus for actuating the pilot light consists of the cup L (with a liquid seal) suspended from the inverted cup I by means of a rod. The lower or body portion is formed with a downwardly depending tube M, and there is sufficient room for the gas to pass from the port J into the chamber K—that is to say, when the appliance is in the inoperative position—and to the pilot light by means of a port to one side of the depending pipe M. When in the inoperative position, the light at the burner is extinguished, and the pilot light is lighted—the gas passing to the pilot tube N.

Let it be assumed that the burners are lighted, and the apparatus in the operative position shown, and that the lights are required to be extinguished. Or (say) in the first instance, there is a district in which the lights have not been lighted. But in another district the lights are lighted. The wave of pressure may be conducted to the interior of the bell H in the chamber F, and the increased pressure allowed to pass to the burner-pipe G without affecting the working of the auxiliary apparatus in the chamber A—that is to say, the auxiliary bell C allows of a considerable margin over and above what it takes to operate the bell H, before the bell C is actuated

When it is desired to extinguish the lights, the pressure of gas is increased in the pipe E sufficiently to lift the bell C of the auxiliary chamber A. The gas to effect this lifts the bell in the upper inverted cup so that it can pass down to the chamber F, and so that this extra pressure of gas is exerted on the outside surface of the bell H. Similarly, as the pressure of gas is increased and passes to the interior of the bell C it also passes to the interior of the bell H of the chamber F. Thus the pressure is the same at the outside and inside of the bell, and the bell is put in a state of equilibrium. Further, by force of gravity the bell H falls and cuts off the supply of gas.

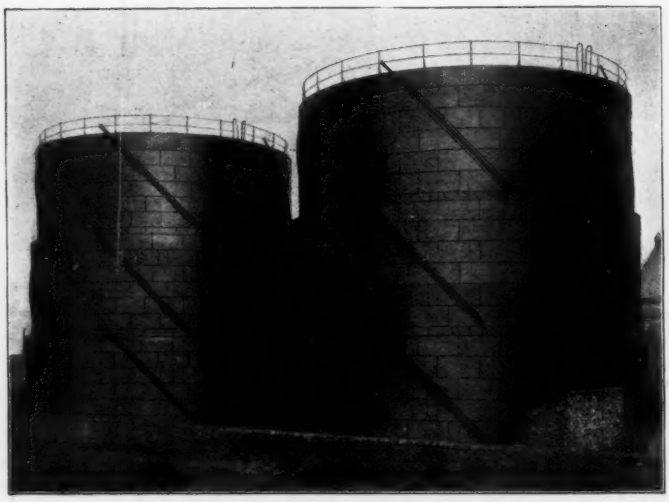
Water Companies and the Income-Tax Question.

Our readers are aware that the subject of the proper allowance to be made for depreciation of plant for income-tax purposes is receiving attention by the Gas Companies' Protection Association as well as by others concerned in the administration of gas companies' undertakings. We learn from Mr. R. L. S. Badham, the Secretary of the Provincial Water Companies' Association, that the question has on several occasions been very fully discussed by the Committee, and that they have had interviews with the authorities at Somerset House with reference to the circular sent by the Board of Inland Revenue to the Surveyors of Taxes, setting forth that no depreciation should be allowed in any circumstances in respect of any portion of water undertakings. It appears, however, that the circular is not being strictly acted upon, as Mr. Badham has heard from several members of the Association that similar allowances to those granted in the past had been sanctioned for the present year. The Committee are not unanimous as to whether the old system of allowance or that proposed by the circular—viz., "that all expenditure on repairs and renewals is to be charged and allowed as working expenses as and when incurred"—is the more advantageous; and, judging from the course recently taken by the Surveyors, it would seem as if the companies could practically take their choice as to which system they would come under. The matter is to be further considered at the next meeting of the Committee.

The Calcutta Lighting Contract.—It may be remembered that at the recent meeting of the Oriental Gas Company various inquiries were made in regard to the possibility of the new contract for the lighting of Calcutta which had been entered into between the Company and the Corporation being ratified by the Bengal Government. We learn from the Secretary (Mr. H. J. Luff) that the Directors have received intelligence that it has now been sanctioned.

SPIRAL-GUIDED HOLDERS AT NORTH ORMESBY AND GUISBOROUGH.

The Guisborough Gas Company, Limited, during the present year decided to pull out their existing single-lift gasholder, which was 36 feet in diameter by 15 feet deep, and to replace it with a three-lift spiral-guided gasholder. This was arranged with an inner-lift of 32 feet, a middle lift of 34 feet, and an outer lift of 36 feet; all three lifts being 15 feet deep—making the total height from the bottom curb to the top of the dome of holder 44 feet, after deducting the cups.



The Spiral Guided Gasholders at North Ormesby.

The Three-Lift Spiral Guided Gasholder at Guisborough.

The contract was placed with Messrs. Robert Dempster and Sons, of Elland; and the accompanying view shows the tower-like proportions of the structure, which, in spite of its height as compared with its diameter, is, we are assured, more than amply strong to withstand any storm.

This gasholder was erected as the outcome of the Directors of the Guisborough Company seeing at the North Ormesby Gas-Works, two similar holders, both of which were erected by the same firm, and of which we also give an illustration. The holder on the right-hand side has a diameter of 48 ft. 6 in., and a total height of 48 ft. 5 in.; that on the left-hand side is 48 ft. 6 in. in diameter, with a height of 49 ft. 2 in. to the top of the dome.

PHYSICAL SOCIETY'S EXHIBITION.

As briefly mentioned in the "Journal" last week, the Physical Society of London arranged to hold to-day their fifth annual exhibition of apparatus, at the Imperial College of Science and Technology, South Kensington. We have been furnished with brief descriptions of the exhibits, and take from them the following particulars of those in which our readers are most interested.

The Cambridge Scientific Instrument Company, Limited, had on view Féry radiation and spiral pyrometers, each in use in connection with a Méker furnace. The former is a great improvement upon the instrument shown last year; among the advantages secured being robustness, a more open scale, and independence of accurate levelling. The spiral pyrometer is a radiation pyrometer, and a modification of the one just mentioned. The instrument is completely self-contained, very simple and easy to use, but less accurate than the other. Both the Féry pyrometer and the Méker burner have been described in our columns. The Company also showed a pocket gas-pressure gauge and a leakage indicator. The former is a compact and sensitive dry gauge; its action depending on the movement of an aneroid chamber which controls the pointer. The standard range is zero to 8 inches of water pressure; but it is also made with a range up to 60 inches for high-pressure gas. The leakage indicator is an ingenious application of the principle of the diffusion of gases. An elastic metal chamber is closed by a porous tile. When it is brought into an atmosphere charged with gas, the gaseous atoms diffuse through the tile with greater rapidity than the enclosed air passes out. The pressure in the chamber is thus temporarily increased, causing expansion, which is communicated by mechanism to a dial pointer. It is stated that surprisingly minute leaks of gas may be detected in this way.

Messrs. Everett, Edgcumbe, and Co., Limited, had on view a photometer bench for laboratory and central station use. This apparatus comprises a 10-feet metal bench with travelling carriages, &c., and is provided with a special Everett-Edgcumbe direct-reading adjustable screen photometer head, which can be used either as a "flicker" or as a comparison photometer. A further advantage claimed for it is that it enables the final, or, if preferred, the entire, balance of illumination to be made on the head itself, without it being necessary to move either of the lamps. The complete equipment includes a rotating lamp-holder for the measurement of mean horizontal candle power. The firm also exhibited a universal pattern Trotter illumination photometer for indoor and outdoor work, and an application of it for daylight use made by Mr. Trotter in 1895. The daylight attachment consists merely of a tube, 10 inches high, placed over the horizontal perforated screen of the photometer, and having a side tube for inspection and stops for controlling the illumination of the screen. The unit of illumination is accordingly what would be received from an unobstructed hemisphere of sky.

Messrs. J. J. Griffin and Sons, Limited, showed, among other things, a radiator devised by Mr. R. H. Smith for measuring the heat radiated from a fire or stove; and a temperature recorder connected to a quartz glass platinum resistance thermometer.

Messrs. Elliott Bros. showed the latest form of Harrison photometer, with an attachment enabling it to indicate the total horizontal illumination; also the Harrison and Slaughter maximum demand indicator, and the Wimperis accelerometer and gradient measurer for the use of engineers.

Royal Institution Lectures.—Among the lectures arranged for delivery at the Royal Institution before Easter are three by Professor Silvanus P. Thompson, on "Illumination, Natural and Artificial;" and six by Professor Sir J. J. Thomson, on "Electric Waves and the Electro-Magnetic Theory of Light."

Royal Sanitary Institute Congress and Health Exhibition.—In connection with the Twenty-fifth Congress of the Royal Sanitary Institute, a Health Exhibition is to be held in the Royal Pavilion, Brighton, next September, full particulars as to which, together with forms of application for space, can be obtained at the offices of the Institute—Parkes Museum, No. 90, Buckingham Palace Road, London, S.W. The exhibition will comprise four divisions, and six classes. In Division C, Class III.—"Heating, Lighting, and Ventilating"—embraces heating apparatus; cooking apparatus; smoke-preventing appliances; lighting, including electric lighting; ventilating gas-burners; and ventilators. In the same division, Class II.—"Water Supply and Sewerage"—includes apparatus for water supply; filtering, softening, and purifying of water; water-waste preventers; and flushing and watering. Silver and bronze medals will be awarded at the discretion of the Judges; and a complete classified and illustrated list of exhibits, to which awards have been given by the Institute, is published by the Institute. A special medal will be awarded for household sanitary appliances in case of pre-eminent merit, which will be called the "Rogers Field Medal."

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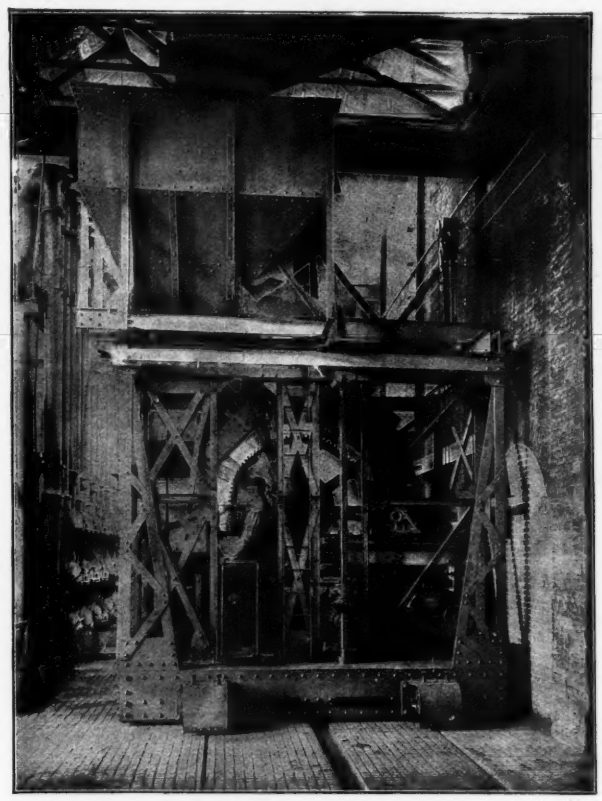

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LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of the Association was held last Friday evening at the Cripplegate Institute, Golden Lane, E.C.—the PRESIDENT (Mr. W. J. Liberty) in the chair. There was a good attendance of about sixty members, to hear a lecture by Mr. JACQUES ABADY, on "Light—And Some Reflections." On taking the chair,

The PRESIDENT said he had much pleasure in introducing to the members a gentleman whose name was very well known in the gas industry, and who had kindly consented to give them a lecture. Without further remark, he would call upon Mr. Abady.

LIGHT—AND SOME REFLECTIONS.

Mr. ABADY, who was received with applause, said he was very much obliged to the members for inviting him to come there that evening. It gave him great pleasure to be with them; and he was more grateful still that, having invited him, they had come themselves to hear the lecture. He fully realized that many of them came from a long distance; and, considering the condition of the weather, this showed great enthusiasm for the cause. However, they had come to listen to him speak on a subject about which probably many of them knew more than he did. He felt a certain amount of hesitancy in talking to them about light, because he realized quite well that he was in the presence of men who possessed what was better than any amount of theory—that was, practical experience in all matters relating to the production and distribution of light. In fact, he imagined that many of them wished that they could keep away from light sometimes.

AVOID EMPIRICISM.

The particular aspect he wished to speak about that night was empiricism, which he thought he might define as the "state of being empirical." The dictionary said that anything which was empirical was something which depended upon observation alone—without due regard to science and theory. Photometry, which he was going to speak to them about—or the measurement of light, which was the same thing—was a subject into which so many attempts were made to introduce empiricism, that he wanted to point out to them how foreign the introduction of any such empiricism was in their daily practice. Although they might not have observed it, in pursuance of their calling as producers of gas they really avoided anything in the nature of empiricism.

If they took construction, for instance, dimensions were founded upon something they could measure. He believed that there was a standard foot in Trafalgar Square; but any way there was one in the Standards Department. And although pitching upon the foot as a standard might have been quite an empirical thing, still having once got a foot, they could always verify measurements. Again, with constructional work, stresses and strains and any sort of dimensions or qualities were all dependent upon laws the certainty of which they knew—the immutable law of the lever, for instance. They knew perfectly well what this was, and that it was present in pretty well all mechanical movements. And in making any calculations, they knew that they were founding these calculations on something that was definite, and something to which they could with an amount of confidence refer back. They had not to take anybody else's word; they could determine it for themselves. As to temperatures, they used thermometers which they could verify at either freezing or boiling point. They had something definite there; and they knew their temperatures were definite. Exactly the same with the atmosphere. There was nothing empirical about that. They weighed the atmosphere with the barometer. Just the same when they applied temperature and atmospheric pressure to gas volume, they used these definite measurements. There was nothing empirical there.

So it was with the photometer standard. When they got to the test-burner, he did not know about that. There was something empirical in the value assigned to the 5 cubic feet of gas. When they called it 10, 15, or 16 candles, they knew it depended upon the particular burner used; and it might depend also on the gas examiner. But they all knew that the standard by which it was measured was very definite. They knew that the 10-candle pentane standard was referable to a standard sperm candle made in a particular way. So that right through the operations they were accustomed to carry out daily, or more or less often, there was nothing whatever of empiricism.

He was speaking to an audience who very modestly dubbed themselves an Association of Juniors. He must take it that they were juniors, and act accordingly. If one was struck with the truth of a thing, he must impress it upon others—especially juniors; so that when the time came for them to do work in a particular direction, they might know where they were.

THE LAW OF PHOTOMETRY.

Now he would go a little further, and deal with photometry. The fundamental law of photometry was the law of distances. That was, the amount of light falling directly on a surface was inversely proportional to the square of the distance from the source to the surface. There was nothing empirical about that. It must be so. There was another law which was applied in photometry; and although it might be true to a certain extent, he thought—and those who knew his opinions about photometry knew that he thought, and always had thought—that it should be avoided. He was talking about the cosine law, which was that the amount of illumination received on a surface obliquely was proportional to the cosine of the angle which the light rays made between the normal and the surface which received the light—in other words, the amount of light falling obliquely was proportional to the cosine. He accepted this as true; and it was true with very great limitations.

PRESENT-DAY LIGHTING CONDITIONS.

The particular reason, he thought, why it was necessary that there should be great accuracy with respect to photometrical operations nowadays would be apparent to those present. First of all, they were not living in the palmy days of the flat-flame burner, when there practically was no light. Their conception of light to-day, compared with what their conception was in the days of the flat-flame burner, was quite different. Had they been in that room 25 or 30 years ago, they would have had to put up with very much less illumination. What the eye was accustomed to, the eye wanted; and consequently people who produced gas, and people who produced electricity, were vying with one another to "go one better." The practical point which concerned gas men was that there was now competition for private lighting, the lighting of large interiors, and for street lighting; and in very many cases the whole battle ranged round what was the total illuminating power that was going to be provided, and what was the illuminating power going to be in the areas or streets that were to be lighted.

On the point of the public getting accustomed to a better light, he might relate a little incident which occurred recently in connection with the Westminster City Council. He was Chairman of the Works Committee of the Council; and his attention was drawn to a paragraph in a paper which recorded the verdict of a Coroner's Jury in an inquest which was held on the body of a gentleman who was run over in Hanover Square. The Jury expressed the opinion—of course, they did not know anything about it, but some doctor went into the witness-box and expressed his opinion, and so they expressed theirs—that the square was not properly lighted. Well, he found that in Hanover Square there were six arc lamps, at 40 volts each, consuming 10 amperes; and at the particular point where this unfortunate man was run over and killed, there was a refuge with an ordinary gas-standard with three incandescent burners. He was just underneath this, and the arc lamps could not have been more than 30 or 40 feet away; and yet the Jury said the square was not properly lighted.

The explanation was very simple. They had probably seen the orgy of lighting in Oxford Street, which simply consisted of filling the firmament with electric flame arcs. The Westminster Council had adopted a similar system along Regent Street; and the explanation of why Hanover Square was said to be poorly lighted was that, when people came from the glare of Regent Street into the square, it seemed to them there was really no lighting there at all. Take away the brilliant light from Regent Street; and no one could say from any point of view that the Hanover Square area was not properly lighted. So they would see the importance of the point he wished to make in connection with the competition there was between different kinds of lighting at the present day. This rendered it necessary that everybody should be absolutely certain of his ground, whether engaged in trying to knock electric lighting out of the streets, or *vice versâ*.

ILLUMINATING POWER AND LIGHTING EFFECT.

In this regard, there were two points from which they wanted to view light. One was the point of view of the illuminating power of the source; the other was that they needed to get at the illumination or lighting effect. The reason why they required to know the illumination of the source of light was quite obvious. Probably most of his audience would have, in the course of their daily duties, all sorts of lamps and burners of every type brought to them along with allegations that nothing could be found to compare with their very small appetites for gas, and that nothing else gave such a good light for so small a gas consumption; and they had to test the duty, to verify or otherwise the statements made. To do this, they needed to accurately measure the illumination, so as to ascertain the candle power; and, of course, they could arrive at the duty by ordinary measurement. In the old days, when they had small units, it was not so necessary as it was now to take measurements of angles. If they simply put up the burner and measured its light in the horizontal direction, it would then have sufficed. But to-day it would not be sufficient; because, quite apart from the question of measuring the illuminating power of a lamp in order to verify the makers' statements, they might easily be called upon to find out the distribution of the illumination of a particular lamp. They might want to be able to plot-out a system of lighting; and if they did not know in which direction a particular lamp threw its light, they would not be able to accurately plot it out.

Therefore, they needed accurate knowledge of the illumination of a source of light. The other point, of course, was "illuminating effect;" and he thought there was a good deal of confusion as to what illuminating effect was. Illuminating effect was supposed to be the light on any particular spot chosen, irrespective of the source whence it came. But they would see that it was practically impossible to measure illuminating effect if they accepted this definition. They could take a photometer and point it at a particular lamp and get the illuminating power by any reasonable means, because they could measure the distance, and so on. And

if they took the illuminating power, and divided it by the square of the distance, they got the illuminating effect in foot-candles—or they thought they did. It appeared to him the illuminating effect was not the light on a certain spot irrespective of where it was received; it was the light that was reflected from a certain object, and it seemed to him the material on which the light was reflected very seriously affected the illuminating effect. They could not reckon the illuminating effect as being the power of the source divided by the square of the distance. It was the light reflected from the particular material on which it fell. They could not measure the light falling on the source, but only the light reflected from the receiving surface, if the receiving surface was capable of reflection. An electrician would tell them that, if they wished to test illuminating effect, it did not matter about the source. What they wanted to do was to take the number of foot-candles with a photometer like a camera. He (the lecturer) said that what they had to do was to measure the light reflected from the receiving surface. This was the only test of the comparative advantage of a scheme of lighting. This being so, the members would quite see that the true illuminating effect depended upon the surface itself as well as upon the power of the source of light. When they wanted to get comparative tests of the true illuminating effect, it seemed to him perfectly obvious that they must always measure the illuminating effect in terms of the light falling on a standard surface remaining always the same. Take, for instance, Whitehall. There, though the lights might be the same on a wet and a dry night, they would get an absolutely different reading, because the dry, clean surface would reflect more light than the wet. This was another proposition they wanted thoroughly to grasp and to fully understand.

Testing at Angles.

Well, then, there was the question of testing at angles, which was another thing that they wanted to be able to understand. Those were the two points—the question of how to test at angles, and the question of the true measurement of proper illuminating effect. He was going to deal with the matter from a laboratory point of view, and also from a street point of view; and he had brought a photometer for the design of which he was responsible. He had not done this for the purpose of advertising the photometer, but to illustrate his points. There was no patent about it, except the "Flicker" disc box; and if anyone could design a photometer with avoidance of empiricism like that, it was just what he himself said should be done. There were enough difficulties connected with the question of measuring illumination—particularly true illuminating effect—without bringing in the difficulties and doubts that they would do if they introduced anything empirical.

In testing at angles, it meant that they were testing the light falling upon the disc box at a particular angle; and the angle expressed always meant the angle of depression from the horizontal. Before they could talk of the light being at a particular angle from the disc box, they had to put the light and the disc box in a certain position. Consequently, as a means of comparison they could not move the disc box unless they moved the light as well, so as to preserve the same angle in reference to the disc box. In testing at angles, they could not get their reading for equality by merely moving the disc box; and so it was necessary to find another method.

There were several ways in which it could be done. It was obviously possible to move the standard of light; but if one had a 10-candle pentane standard, he should not himself call it the most portable thing on earth, without any change taking place in the light. It was pretty clear, therefore, that this was a method which was not desirable.

Then they could get another form of standard which could be moved; and the thing that would at once suggest itself to his audience was an electric standard lamp. He used such a lamp a good deal himself; and there were many advantages and disadvantages connected with it. If an electric standard lamp was used, what had to be done was to verify it by an original standard of light, and then to take a measurement either of the current or the voltage of the lamp. The latter operation should be carried out from time to time. If it was found that the lamp gave (say) 16 candles at 201·5 volts, it was necessary to make certain that the voltage was kept at this figure; and to do this, it was requisite to introduce a resistance—so that then they had two pieces of apparatus. And they could not be certain that the same voltage would always produce the same candle power, because the efficiency of the lamp varied. This was another factor which should always be checked before and after a test. The thing was that they could use an electric lamp the value of which was known, or could be ascertained by comparison with the standard, and move that up and down the bar.

Supposing they wanted to measure at angles, and preferred not to introduce anything with a filament into a gas-works, they could use what in his opinion was the most admirable form of secondary standard they could have; and that was an argand burner with a screen in front of it with adjustable shutters. Supposing that the standard light was masked, and the lamp was at any particular angle, they would simply open or close the shutter in front of the gas-burner, and stop it at the point when they had opened the screen to such an extent that the light falling from it was equal to the light falling on to the disc box from the lamp being tested. The only thing that could alter would be the illuminating power of the burner; and that would have to alter in about two minutes, which was all the time it took to make the test. They were taking a little piece out of the flame which was liable to very trifling change. Consequently, this was a double standard method which he had found extremely accurate.

There was another way of applying this double standard, and that was by having the burner close to the disc box, coupling them together, and making the reading in exactly the same way, by opening or closing the shutters. Then they could move both burner and disc box along until they had equality with the Harcourt pentane lamp. After that, all it was necessary to do was to divide this latter distance into the distance between the lamp tested and the disc box, and square the product and multiply by the power of the standard of light, which, if a Harcourt lamp was used, would be 10. He had tested as high as 1500 or 1600 candles. One observer after another—Mr. Simmance, Mr. Grimwood, and Mr. Foreman—had taken readings; and they had all agreed within one or two candles. Of course, one had to be particularly careful in the measurement of the distance; but this method of testing at angles appeared to him to be very simple, and one of the best that could be used.

Though some years ago he had a settled view that no test was good unless it was a spherical measurement, he had since come to the opinion that all one wanted was the lower hemispherical measurement and the distribution curve. With ordinary usage, they could photometer a lamp at all angles inside an hour-and-a-half easily—probably quicker. Supposing one wanted to test the illuminating power of a lamp in different directions in a street, it was not easy always to measure the distance; and, of course, they would know what to do there. They had simply to imagine a triangle, and solve it. If the base measurement was available, multiplication by the secant would give the distance from lamp to photometer; if the perpendicular measurement, employment of the co-secant would give the distance. He thought it was best to get a standard distance they could be certain of, and perhaps the perpendicular or the height of lamp-column from ground to centre of flame was the better. He had endeavoured to describe some practical and direct reading methods of testing lights in a laboratory at all angles; and the preceding few lines applied to measuring the distance between the light and the photometer either in a laboratory or in the street. In street testing, however, there were other difficulties which he would now endeavour to describe and show them how they could be circumvented; but whether they took tests in a street or a laboratory, they got the illuminating power by a direct reading. They could plot out the illumination at any point by getting the light in each direction, or they could get the mean hemispherical intensity by the usual factors.

Street Testing.

Now, in a laboratory, they had their original standard light—flame or otherwise, and had plenty of room and facility for making the comparisons. But when one wanted to test the illumination in a street, it was a rather different position. There were several alternatives. First, one could vary the distance of the standard of light; but the difficulty of this as applied to the photometer in the street, was that one was limited by space, because it might be desired to test a very high power lamp or one of very low value. Therefore the range of light and distance with a moving electric lamp had to be very big; and this would affect the portability of the instrument.

Another alternative was the Talbot law utilized in the form of a rotating sector. One disc was superimposed upon another which could be opened or closed so as to make an open sector bigger or smaller. The amount of light received would be proportional to the open part of the disc compared with the area of the sector. It was necessary to have some mechanism for spinning, and by which the opening could be made larger or smaller while it was spinning. This required a considerable amount of ingenuity; and in street testing he thought it was not quite practicable. Besides, it was an added objection that there was a good deal of empiricism in it. One had to graduate the openings and to find values for them; and it rather fell to the ground for this reason.

Another method which was largely used was the inclination of the surface upon which either the standard light or the light to be measured fell. This was what was called a cosine photometer. The idea was, he thought, exploded among all people who knew anything practical about the subject. Lambert's cosine law, which really applied, as was shown, to light received upon a surface, would hold good for light which was reflected, if it were perfectly diffused reflection; but one could not get a surface that did give perfectly diffused reflection. Besides the fact that one did not get perfectly diffused reflection, there was the question of the point at which one looked at the receiving surface. If they took a piece of cardboard, and held it in the light, they would see that, according to the point of viewing, the light altered. Consequently, the contention that one could make a photometer by letting the light tested fall on one side of the disc or photometer head, and allowing the standard of light to be reflected from a cardboard or paper screen, which was inclined until there appeared to be equality, and then saying that the light was proportional to the cosine of the angle of inclination of the cardboard screen, was really absurd. Mr. Trotter, who was first responsible for this extraordinary application or misapplication of Lambert's law, had recently stated that a perfect diffusing surface was unnecessary, because all instruments had to be graduated by experiment, and the moving screen need not obey the cosine law at all.

They therefore came back to their old friend empiricism; and he would leave the so-called "cosine" photometers at that.

Mr. Gaster, who championed the cause of "scientific illumination," delivered a series of Cantor Lectures at the Society of Arts, and described without comment or criticism two perfectly preposterous photometers. Those who advised these photometers were nearly all connected with the electrical industry. It was time that somebody should speak strongly, when such photometers as these were calmly brought forward in a series of learned lectures by a gentleman who studied the science of illumination and edited a paper on the subject. The lecturer then proceeded to criticize the two photometers shown on page 858 of the "Journal of the Society of Arts" for Sept. 3, 1909.

A Direct Reading Illumination Photometer.

He would like to show them that it was not impossible to make a portable photometer in which there was absolutely nothing empirical; and he had brought such an instrument for them to see. It was a new thing, and it was not one with which he was perfectly satisfied; but he wanted to explain how it was possible to make tests without anything empirical entering into the calculation. First, it was necessary to recollect that when one was testing at a particular angle, the disc box could not be moved. There must be some means of varying the illumination on the other side of the disc. The method adopted in this arrangement was an exceedingly simple one. It consisted of a sphere, illuminated on its interior surface by a small glow lamp. It would be obvious that any given portion of the interior surface had an illumination equal to any other similar portion, which was what one would expect from the law of inverse squares, and had been confirmed by experiment. The standard of light was 15 millimetres square of this illuminated surface; and by a mechanical micrometer movement, scaled into 300 equal parts upon a drum, the said 15 mm. of illuminated surface could be gradually reduced until the portion exposed balanced the light to be tested. If, with the scale indicating at 100, they ascertained the voltage necessary to equal a candle held at 1 foot from the photometer, it would be obvious that (this voltage being maintained and observed by a rheostat and ammeter) the scale reading upon the drum, when making tests in the streets, would be in terms of a foot-candle. For instance, 90 would mean 0·9 foot-candle; 210 would mean 2·1 foot-candles. Bearing in mind what had been stated with reference to illuminating effect necessitating a standard reflecting surface, what was done to prepare the photometer for taking illumination readings was to place it 1 foot from the reflecting surface or screen used in the actual measurements, and find the voltage required with (say) a scale reading of 100 to equal a candle held at 1 foot from the reflecting surface, and maintain the voltage as before described. It would thus be seen that here was a method of taking accurate readings of the power of sources of light and also similarly accurate readings of foot-candle illumination without anything empirical entering into consideration.

A day or two ago, he made a test, and got a reading of 0·62 foot-candle measuring directly and calculating; and the reading the other way was 0·615. That was taking into consideration experimental errors. This showed that one could handle the photometer pretty accurately.

The President had probably had experience in taking foot-candle readings. Measuring in foot-candle upon a reflecting surface was not a simple thing, because the foot-candle illumination was so small; but what one had to do was to cover the head entirely and look out of blackness at the photometer. The eye soon got accustomed to the small illumination, and could measure very slight differences with great accuracy.

Conclusion.

He had endeavoured to show them that the increasingly important question of street measurement of light could be carried out by methods as exact and as referable to definite standards as were the laboratory examinations to which they were all fairly-well accustomed.

If the President thought the members of the Association would be sufficiently interested in the subject-matter of the lecture, he would send round (through the Secretary) an accurate transcript of what he had been endeavouring to say.

Questions and Answers.

The President having invited questions,

Mr. J. G. Clark said it had given him very great pleasure to listen to Mr. Abady; and one or two points had occurred to him during the lecture. He was very pleased to hear that Mr. Abady was in favour of the lower hemispherical value rather than the total spherical value. But he would like to state that even the hemispherical value was of very little use without the complete distribution curve in the lower hemisphere. The various forms of integrating photometers which had been proposed were, he considered, quite unsuitable for the discrimination of various sources of light. The ingenious "Flicker" photometer, which was associated with the name of Mr. Abady and Mr. Simmance, provided for the measurement of the flux of light in the various directions so that a complete polar curve might be plotted; and, if necessary, the hemispherical value might be easily deduced therefrom. With these data, together with the energy consumption, one had a very complete knowledge of the photometric value of a source of light. Another interesting point was in regard to the secondary standard of light which Mr. Abady had described. This consisted of an argand flame having in front a screen with shutters the opening of which could be varied at will. This in a way resembled the Methven screen. It had always been an interesting point with him whether, in using such a standard, one should regard the centre of the flame or the plane of the screen as the centre of the source. It seemed to him that neither would be correct, but that the centre of the standard would always be somewhere between the centre of the flame and the centre of the screen—the actual position varying with the distance from the disc or "Flicker" head. He said that Mr. Abady mentioned the importance of a standard surface for illumination measurements. This was, of course, necessary, and was provided for in illumination photometers. Mr. Abady himself used a sheet of drawing paper, the quality of which was defined. It was, he thought, Mr. Trotter who, in explaining that what they called illumination did not have any reference to the nature of the surface, stated, as an illustration, that the rainfall had no reference to the nature of the ground upon which it fell.

Mr. Abady said that what he intended to convey was that the effect of the illumination on any spot did considerably depend upon the surface. When they were measuring illuminating effect, it was not the amount of the "golden rain," but the amount of light reflected; and this did depend upon the surface.

Mr. Clark: And also the amount of light falling on the surface.

Mr. Abady said they wanted to measure both. Naturally the amount of light falling on a surface depended upon the power of the light; but the amount reflected from the surface depended upon the nature of the surface as well. With reference to the centring of the secondary standard, when it was used in the proper way, coupled to the disc box as here described, it did not matter where it was. They plumbed, as a matter of fact, from the centre of the flame, when they wanted to plumb at all. The Methven screen was plumbed from the silver slot.

Mr. J. S. Dow said he was the bearer of a message from Mr. Gaster, the Hon. Secretary of the Illuminating Engineering Society, who had been kindly invited by the Chairman, but was unavoidably detained by a previous engagement. He had listened with great interest to Mr. Abady's lucid exposition of photometrical principles, and heartily endorsed his remarks on the need for exact photometrical measurement, especially in these days when so many different systems of illumination were available. Much confusion was not infrequently caused by the fact that the conditions under which different illuminants were tested were not strictly comparable. Mr. Abady had also suggested that flame-standards such as the pentane standard, and electric glow-lamp standards, had both their respective spheres of utility. It was gratifying to observe how the gas industry were coming to take advantage of electrical apparatus for their own purposes; and Mr. Abady had shown characteristic enterprise both in adopting an electrical secondary standard for use with his interesting photometer, and in applying the diaphragm method in such an ingenious way. It was, of course, now well known that the inverse square law and the cosine law were only accurately true within certain limits. He thought, however, that this did not justify Mr. Abady's sweeping condemnation of all forms of illumination photometers utilizing the latter principle. Such instruments had been developed in Germany and the United States, as well as in this country, and useful work had been done with them. Moreover, the intention of such instruments was essentially different from that of Mr. Abady. They were intended mainly as a means of readily determining the illumination at a given spot in buildings, &c. For such a purpose, lightness and portability were essential, even though these qualities could only be secured by sacrificing the high degree of accuracy aimed at in the laboratory. Mr. Abady had referred to a lecture by Mr. Gaster before the Royal Society of Arts, in which some instruments were briefly described. It was only fair to mention that Mr. Abady had been invited to exhibit his photometer on this occasion, but omitted to do so. In conclusion, he would like to correct one remark of the lecturer's which might convey a false impression as to the aims of the Illuminating Engineering Society. In the official report of the Council, presented at the Inaugural Meeting on Nov. 22, it was expressly stated that "membership of the Society does not qualify anyone to be recognized as an illuminating engineer." For the present, the Society merely wished to provide an impartial platform for the impartial discussion of all problems in illumination, and, he might add, all types of photometers.

Mr. Abady, replying to remarks and questions put by several members, said the intensity of the light from an electric lamp did not diminish in proportion to a drop in voltage. He did not want to say that empirically graduated photometers could not be used at all. All he said was that there were a sufficient number of errors—personal errors—and difficulties connected with photometry, to make it undesirable that anything should be introduced which one could not actually measure. He thought he had made his point exceedingly well, as he had got from Mr. Dow an admission that the photometers he had criticized were not intended to be really accurate photometers. He must strongly object to such instruments. He contended that no photometrical information was better than inaccurate photometrical information. He suggested very strongly that it was totally misleading for anybody to construct a photometer and use his name to get that photometer employed, if he knew that it was not accurate. It was all very well for Mr. Dow to say that the use of the photometers which he (Mr. Abady) had criticized was only for approximate information; but he (Mr. Abady) objected to their being described

in Cantor Lectures without this qualification, and they all knew that engineers and surveyors made reports to their committees based on tests made by such instruments, which it was known perfectly well were not accurate. Though he was speaking to a Gas Association, he was not in the slightest degree prejudiced. He simply stood as a perfectly impartial person, who took a great interest in the subject of lighting. It did not make any difference to him, from a business point of view, whether gas or electricity flourished best. Coming to the personal point, he had declined, and he always would decline, to put his instruments side by side with the apparatus for approximate measurements which were improperly described as photometers. If the word photometer did not mean "an accurate light measurer," it meant nothing at all.

Mr. D. W. Winslow (Lea Bridge) remarked that they often heard of the 3000-candle power arc electric lamp, and the cheapness of it. Looking at these lamps from an ordinary standpoint, one would not credit them with their candle power. Had this anything to do with the light coming from a point? And was the light value from a 3000-candle arc lamp the same as that from a 3000-candle gas-lamp? In the latter case, they had a series of incandescent mantles which presented a considerable area of light. Did the photometer register against the gas, and in favour of the electric arc because of the fact that the latter was more or less a point?

Mr. Abady replied that he did not think the comparative efficiency could be referred to in this way. It depended a great deal on the colour of the light—the actinic quality of the light rays. They would find that an incandescent gas mantle could be seen better on a foggy day; but he did not know that anybody had ever stopped to consider whether he got a better result from a particular arc than from a particular set of mantles, due to the fact that one was a point and the other a group of bodies. If the light was there, it was there. He did not think there was anything in this point.

Mr. Clark, referring to the remarks as to the different photometric value of small and brilliant, compared with large and less brilliant sources of light, said this brought them to the interesting phenomena of shadows, as compared with the intrinsic brilliancy of the source. It was easily demonstrable by graphics that the source having the highest intrinsic brilliancy for a given flux would give the darkest shadows, if an object of any kind be placed in the path of the rays. Take, for instance, a gas mantle having a flux of 500 candles, such a mantle might have a visible area of (say) 10 square inches, and in an arc lamp of the same power the crater of the carbon would be but a fraction of a square inch. The shadows due to the arc would be much more acute than with the gas mantle. He concluded by asking Mr. Abady to emphasize the importance of the complete distribution curve. The mere measurement of the hemispherical intensity was not of so much importance.

Mr. Abady said they required to utilize the sources of illumination in such a manner as to throw the light equally along the pavement in all directions; and they could only arrive at this experimentally by getting a distribution curve—that was, the illuminating power of the lamp in the different directions—and then apply this to actual conditions. One light might be intrinsically better than another on the mean hemispherical intensity; but, taken all round, it might (on account of an unsuitable distribution curve) not be so good for illumination purposes, which was really what they needed. It was therefore necessary to measure the light at several different angles, tedious though this might be.

Mr. Clark proposed a very hearty vote of thanks to Mr. Abady for his lecture. He said it was a subject in which he was interested; and it would be well for all of them to make it a subject for study, as it would, he believed, be of even more importance in the future than in the past. One thing which he thought pointed a moral to the lecture was that the subject of lighting divided itself into two sections. First, they had to produce their light; and, secondly, they had to distribute it. Light might, from this point of view, be regarded as their raw material, to be distributed as direct, reflected, and refracted radiation. In this development, the photometer would play an important part. He thought that they would all agree that Mr. Abady had combined pertinent argument with mild humour, in a way to make his lecture exceedingly interesting. Mr. Abady, he knew, was a very busy man; and for this reason they should appreciate all the more his kindness in being with them that evening.

Mr. J. Hewett seconded the proposal.

The President said it was quite true that what the eye got accustomed to the people wanted. They were getting accustomed to large sources of light; and they would have them. But there was something else to think of. It was necessary to lead, or endeavour to lead, people in this matter. It would not do to put big lamps just anywhere, and say they were going to light the street. The matter must be considered in an intelligent and scientific way; and to do this it was necessary to measure the light, and consider how it could be distributed to the best possible advantage in the area to be illuminated. For this purpose, the best photometer should be secured and carefully worked.

The vote was carried with applause; and Mr. Abady briefly acknowledged it.

The President announced, before the meeting separated, that it had been decided to have a dinner on Saturday, March 5; a number of members having already signified their wish that such a function should take place.

Mr. Clark, writing on Saturday, says: "In further reference to my remarks last evening, regarding the relation of shadows to intrinsic brilliancy of the light source (not total flux), I might have mentioned that this has a very important bearing upon some suggestions I have come across at various times as to how the 'man in the street' may himself discriminate between illuminants by observing the definition of his own shadow. After what I stated last evening, it will be quite evident that such a method is wholly fallacious where any difference in the area of the light source exists. The suggestion is, no doubt, founded upon the old form of shadow photometer, which, for the reasons stated, is quite inaccurate. Such a method would do to compare lights having equal or nearly equal luminous areas; but there it must cease, and I trust we, as a Junior Gas Association, will remember this important limitation."

MIDLAND JUNIOR GAS ASSOCIATION.

Last Saturday afternoon there was a meeting of the Midland Junior Gas Engineering Association, at the City of Birmingham Technical School—the President (Mr. A. O. Jones, of West Bromwich) being in the chair.

The Late Mr. G. Hampton Barber.

The minutes of the previous meeting having been read by the Hon. Secretary (Mr. Harold E. Temple) and confirmed,

The President remarked that their meeting that day was overshadowed by a loss which not only meant the bereavement of one of their members, but which might have an important influence on the future administration and prosperity of the Birmingham Gas Department. He need not say that he referred to the death of Mr. G. Hampton Barber, the late Secretary and Manager of the Department. He had not himself had the pleasure of his acquaintance; but in the opinion of those best able to judge, he was considered to be a most capable and efficient administrator, and he had heard it said that he was a most sagacious buyer. These were both qualities which were of the utmost importance in connection with the management of an undertaking which dealt with large quantities of finished and raw material. Mr. Barber had great power in the management of the undertaking; and it was a power which in less scrupulous hands might have led to the engineering side being neglected, and consequently to the efficiency being brought down. But happily he had a proper notion of the importance of the engineering side of the concern; and for this reason they were losing in him, not only one of the most respected honorary members of the Association, but also a sincere friend. Before sitting down, he might mention that, with the concurrence of the Committee, he sent a letter of condolence with the family in their bereavement; and he also asked Mr. Temple to purchase a wreath, and forward it in the name of the Association. He was sure that in doing this he had carried out the wishes of the members in the matter.

Design and Construction of a New Retort-House at the Adderley Street Gas-Works, Birmingham.

The President said that, as they would have seen from the *agenda* and the advance prints sent out, Mr. C. Carrington Barber was to have read a paper that afternoon describing a new retort-house at Adderley Street. They would, however, quite understand that, in the sad circumstances, he was unable to be present. The Hon. Secretary had kindly undertaken to read the paper for him; and he would now call upon him to do so.

The paper, accompanied by drawings and photographs, and followed by a report of the long and most interesting discussion to which it gave rise, will be found on the facing page. Mr. Barber's reply is, of course, still to come; but we shall hope soon to be in a position to publish it.

At the conclusion of the discussion, a hearty vote of thanks was, on the proposition of the President, seconded by Mr. A. Hancox (Great Malvern), accorded to Mr. Barber for having written the paper and to Mr. Temple for having read it.

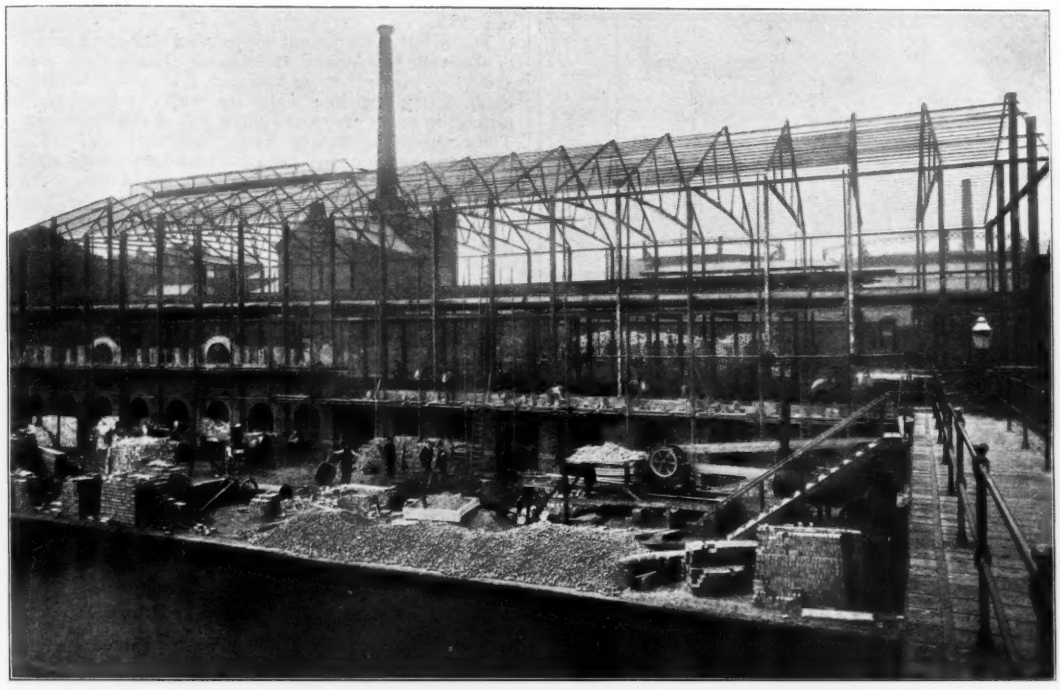
In the report of the proceedings at the meeting of the Société Technique in June last, which appeared in the "Journal" at the time, it was mentioned that prizes were awarded for certain of the papers read at the meeting in Paris in 1908. These awards were made on a report by M. Bouvier on the best papers submitted on the occasion referred to. It will, of course, form part of the "Transactions" for the present year; but it has been printed separately, and the author has sent a copy. The prize winners were MM. Charles D'Aubenton-Carafa, Echinard, Guillet, Du Pasquier, Defoy, Camille Roche, and F. Chevalet, the chief points of whose papers are dealt with in the report. Valuable communications were also presented by MM. Th. Vautier and Marquisan—the former on the proceedings at the sittings of the International Committee on Photometry at Zurich in 1907, and the latter on "New Methods and Appliances for the Distillation of Coal for the Production of Illuminating Gas"—and they are epitomized by M. Bouvier. But, being members of the Committee of the Society, the authors could not be recipients of awards.

DESIGN AND CONSTRUCTION OF A NEW RETORT-HOUSE AT THE ADDERLEY STREET GAS-WORKS OF THE BIRMINGHAM CORPORATION.

By C. Carrington Barber.

[A Paper read before the Midland Junior Gas Engineering Association, Dec. 11.]

These works were formerly the property of the Birmingham and Staffordshire Gaslight and Coke Company, and were erected about the year 1844. They were acquired by the Corporation in 1875, and had a productive capacity of coal gas of about 3 million cubic feet per diem. The carbonizing plant consisted of four retort-houses, direct fired and hand charged, each capable of producing about 750,000 cubic feet per diem. At the present time, there is only one of the original retort-houses in existence; and before long even that relic of old methods must come into disuse and give way to modern improvements.



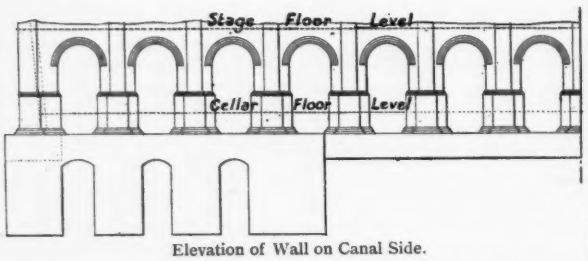
Exterior (During Construction) of No. 2 Retort-House.

The new retort-house erected at these works—the subject of this paper—consists of sixteen beds of horizontals, each bed containing six retorts, 20 feet long, charged and discharged simultaneously by means of a Fiddes-Aldridge machine.

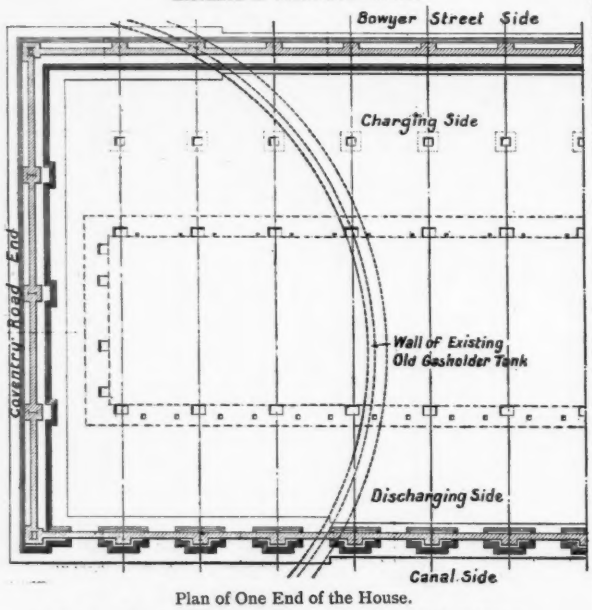
We commenced clearing the site for the new house in November last; and though somewhat delayed by frost and rainy weather, this work was completed and the foundations were laid so as to permit the Contractors (Gibbons Bros., Limited, of Dudley) to commence their work of erecting the house and constructing the retort-benches early in February.

The ground for three-fourths of the length of the retort-house was the site of one of the old retort-houses; and on this portion

View of East Side of No. 2 Retort-House.



Elevation of Wall on Canal Side.



Plan of One End of the House.

Fig. 1.—Foundations for the Retort-House and Retort-Bench.

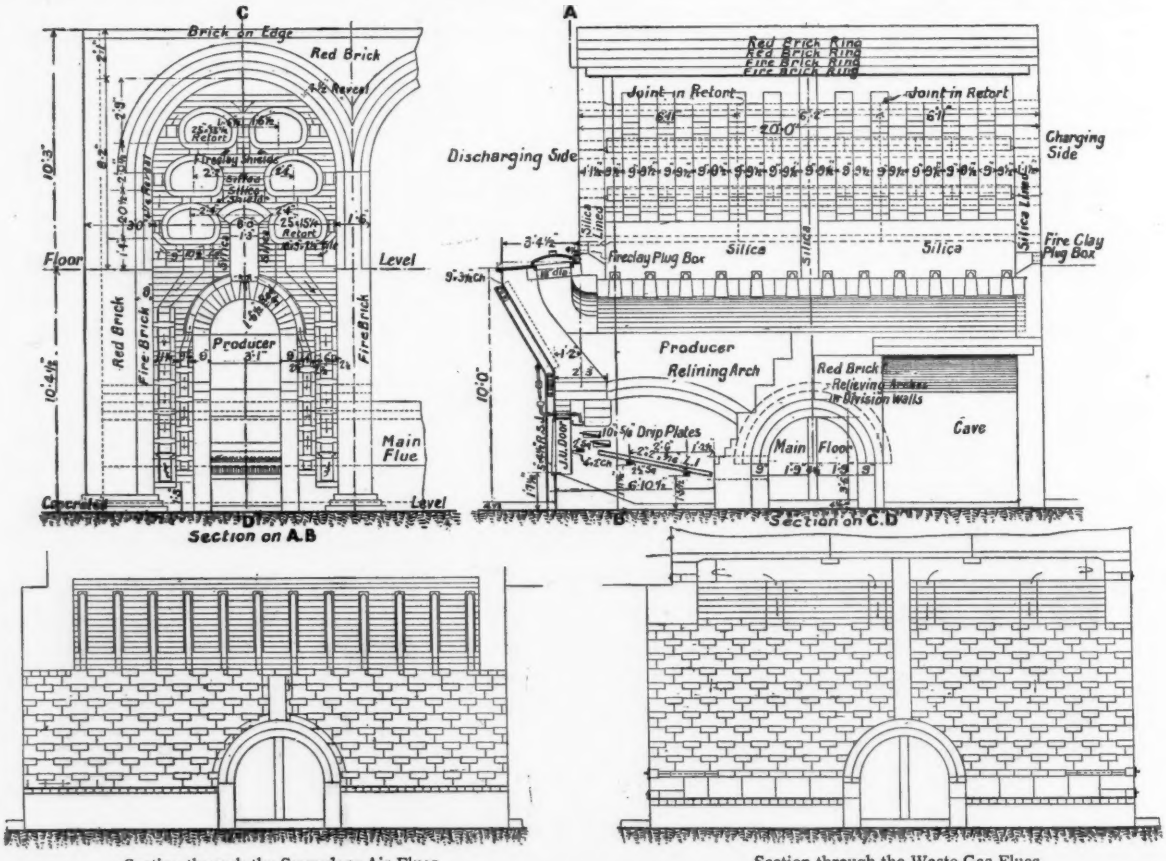
little difficulty was experienced in finding suitable ground on which to lay the concrete foundations. But when excavating the ground for the remaining length of the house, we encountered an old brick and puddle gasholder tank about 20 feet deep that had been filled up with ashes and spent lime, a portion of which had to be removed. This done we then bored through the bed of the tank to ascertain the nature of the ground on which it stood; and this was found to be good, clean dry sand. It was thereupon decided that it was only necessary to carry the foundations for this portion of the house down to the bottom of the tank. The external dimensions of the retort-house are 184 ft. 2 in. long by 58 ft. 2 in. wide; and the retort benches cover a floor space of 161 ft. by 20 ft. The height of the house from cellar-floor level to eaves is 38 feet, and the height of the roof from the eaves is 15 ft. 1½ in.

The foundations of both building and benches were laid by the Corporation, and are formed of concrete consisting of one part of blue lias lime three parts of ballast, two parts of broken brick, and one part of clean sharp sand, excepting under each of the buckstaves, where about one cubic yard of cement concrete was placed. The concrete foundations of the walls forming three sides of the house are 3 feet thick; but at the end of the house, over the gasholder tank, the concrete was taken to the bottom of the tank.

The width of the foundations varied according to the thickness of the walls required at their base. That on the west side was 4 ft. 9 in. wide; that on the east side 4 feet; under the north gable end 5 ft. 6 in.; while the width of the concrete arches formed to carry the south gable end of the building was 7 feet. The concrete foundations for the benches are 3 feet thick, except where the bench comes over the tank before mentioned; and at this point the concrete is carried from the bottom of the tank and arched.

The house is a steel frame erection, with 9-inch brickwork panels above the stage-floor level; the piers being 1 ft. 6 in. thick and 1 ft. 10½ in. wide (fig. 1). The frame of the house is built of rolled steel joists. There are 46 vertical stanchions—20 down each of the sides, and 3 along each end. The four corner or principal stanchions are composed of two 12 in. by 3⅜ in. steel channels, riveted together, fitted with base plates, cover plates, and head plates. The remaining stanchions are formed of 12 in. by 6 in. rolled steel joists; the whole of the stanchions being tied together by means of 12 in. by 3⅜ in. steel channels and 8 in. by 5 in. rolled steel joist ties placed horizontally.

The roof is of steel, and consists of 18 principals with the necessary wind-ties and purlins. Each of the principals is built up as follows: The main rafters consist of two 4 in. by 3 in. by $\frac{7}{16}$ in. angles placed back to back, riveted together; and they are 32 ft. 11 in. long. The long struts are of 3½ in. by 3½ in. by ⅜ in. mild steel angles, 9 ft. 4 in. long. The main ties are of 4½ in. by $\frac{7}{16}$ in. mild steel flats. The tension ties are made of 3 in. by ⅜ in. mild steel flats, 11 ft. 6 in. long, and 3½ in. by $\frac{7}{16}$ in. mild steel flats, 14 ft. 1 in. long. The shoes are made of two 12 in. by ½ in. mild steel flats, riveted together, with distance-pieces inserted between them. The wind-ties are 3 in. by 3 in. steel angles; and the ends are boxed to form cleats, each of the ties being secured to the top rafters by two ¾-inch bolts. They are arranged in two sets on each side of the roof, starting from the gable ends, striking upwards



Section through the Secondary-Air Flues.

Section through the Waste-Gas Flues.

Fig. 2.—Details of Settings.

to the apex, and meeting on the wall-plates at the centre of the house. The roof is covered with 24 in. by 12 in. Bangor slates. A louvre runs along the whole length of the house over an aperture 5 ft. 6 in. wide; the louvre being 6 ft. 3 in. wide and 2 ft. 8 in. high above the apex of the roof. The louvre standards are of cast iron; the rafters of 3½ in. by 3½ in. by ½ in. mild steel tees.

The charging and discharging floors are formed of ¼-inch steel troughing, filled in with concrete and paved with blue bricks. The steel troughing is supported on 16 in. by 6 in. rolled steel joists on the charging side, and 12 in. by 6 in. rolled steel joists on the discharging side; the joists supporting the floors being 9 ft. 6 in. apart, supported by brackets fixed on to the main stanchions and to the buckstaves. The charging floor between the wall and the bench is 21 ft. 7 in. wide; and the discharging floor is 15 ft. 1 in. wide. Rails are fastened to the floor joists on the charging side for the Fiddes-Aldridge machine to travel upon. A space of about 1 inch is left between the sides of the floor and the house-walls to allow for expansion. Extra support is given to the floor on the charging side by placing steel vertical supports 12 in. by 6 in. midway between the wall of the house and the retort-bench. The floor joists are held in position on the brackets above mentioned by ¾-inch bolts passed through slotted holes, so as to allow for expansion and contraction and thus prevent the pushing of the main stanchions and walls of the house out of perpendicular.

It was stipulated in the contract that the cast-iron to be used was to be of such quality that bars 3 ft. 6 in. long, having a section of 2 in. by 1 in. would stand a load of 26 cwt. in the centre of a 3 feet span before fracture. All mild steel had under test to show a tenacity of not less than 26 tons or more than 32 tons per square inch, with an elongation of not less than 20 per cent. on a length of 8 inches or more than 40 per cent. reduction of area at fracture; and, further, strips of any of the steel used, whether for plates, bars, angles, tees, or channels, were required to bend cold, without previous annealing, over a diameter equal to twice their thickness, till the opposite sides were parallel without showing any signs of cracking.

The retort-house has a productive capacity of 1⅜ million cubic feet of gas per diem. There are two retort-benches in line, each containing eight beds of six retorts 25 in. by 15½ in. ⏢ section, and 20 feet long. The retorts are heated by Gibbons and Masters' patent "A.B.C." regenerative furnaces. The waste gases and secondary air are baffled by means of Gibbons and Masters' patent "A.B.C." tiles. These tiles are 2½ inches thick, and are placed back to back, and so arranged that the joints are

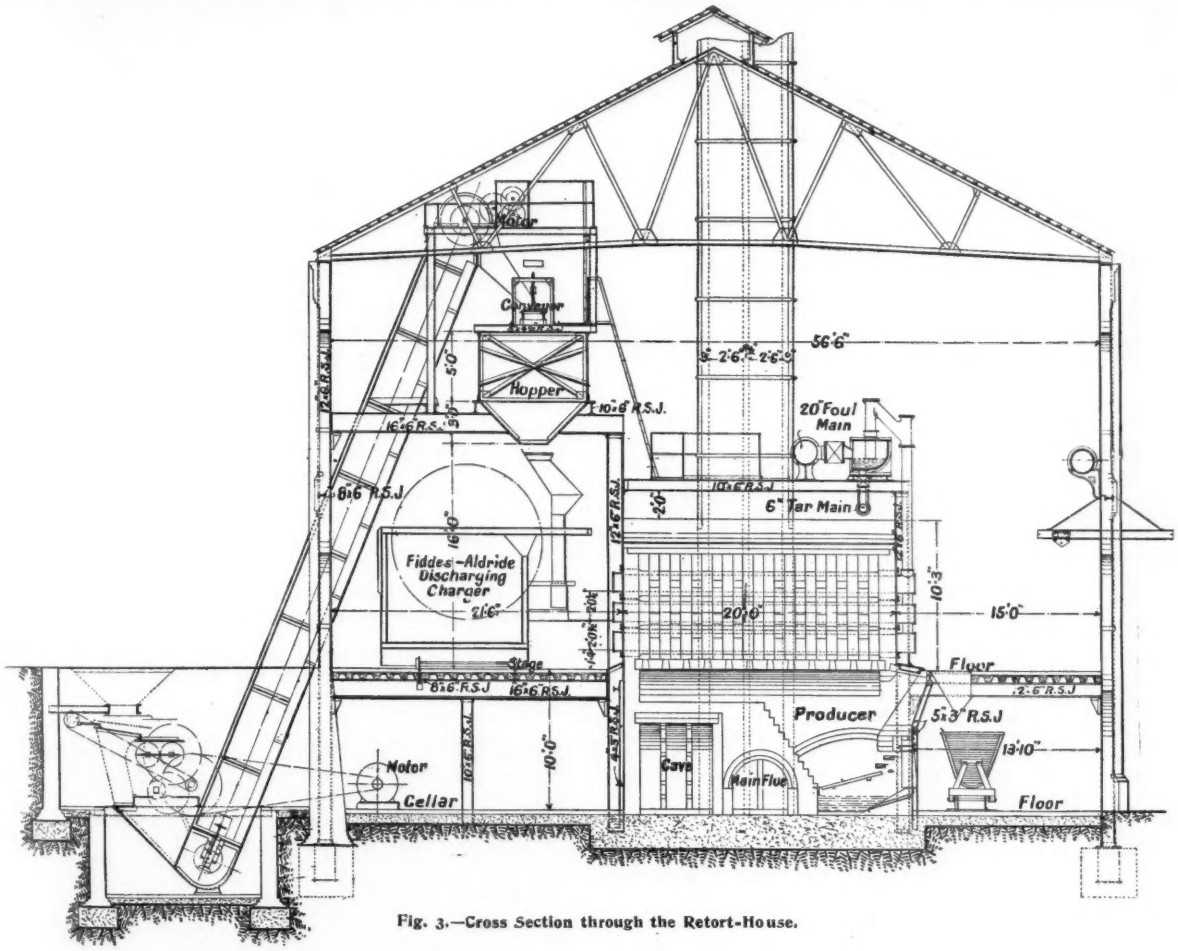


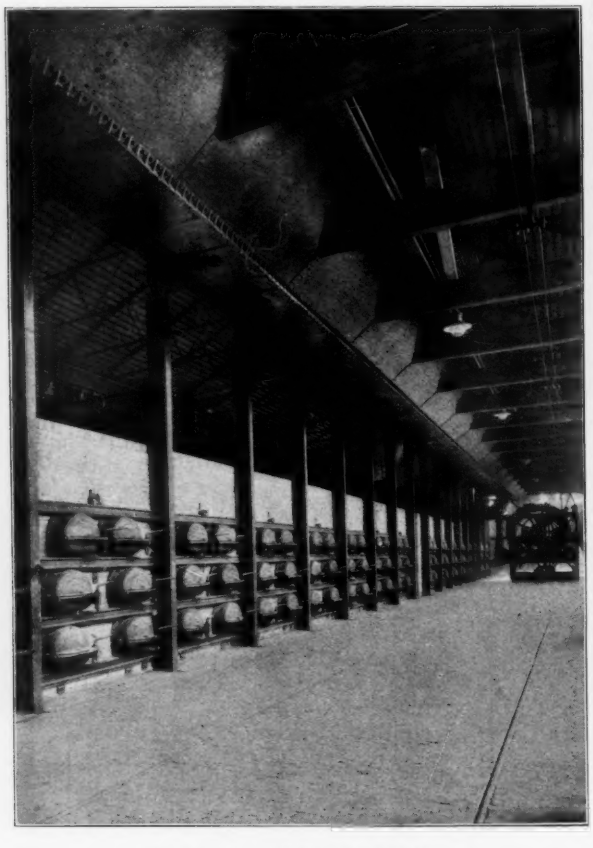
Fig. 3.—Cross Section through the Retort-House.

all broken to prevent, as far as possible, short-circuiting between the waste and secondary air flues. The intention of the panelling is to assist the transmission of heat from the waste-gas flues to the secondary air flues; and there is a nib on each of the baffle-tiles to keep the panel-tiles in position.

The main flue is divided by means of a 4½-inch mid-feather, so that the pull on both sides of the settings may be easily controlled. There is a separate stack to each bench, built-in with the end wall; and the mid-feather in the main flue is continued to the top of the stack. The heating of the retorts is under complete control; each bed being regulated by a set of four dampers. A 9-inch wall divides the setting above the producer arch. The nostrils in the producer arch, twelve in number, are placed equidistant. The combustion chamber is built with Yorkshire silica bricks; and the silica work is continued to within 3 inches of the top retorts. The main arches are semi-circular, constructed of two courses of 4½-inch fire-bricks, and two courses of 4½-inch common brick. The haunches of the arches are filled in with common brick; the whole being capped with 6½ inches of common brickwork.

There is one ascension-pipe, 8 inches diameter, to each retort; and all the ascension-pipes are placed on the discharging side. The hydraulic main is ⊐ shaped, 2 ft. 6 in. wide on the top side. It is divided into sections, one for each bed, and is supported on cast-iron saddles resting on rolled steel joists, connected to the buckstaves. There is a tar-tower to each bench, connected with the hydraulic main by means of a 6-inch pipe. A 10-inch Cort's weir-valve is fixed to each section of the hydraulic main, so that in the event of the latter getting out of level, or the tar-main becoming blocked, the seals on any section can be regulated independently of the tar-tower. The foul main, 20 inches in diameter, is of wrought steel, $\frac{5}{16}$-inch thick, made in sections flanged and bolted together; its total length being 370 feet over all. A 10-inch retort-house governor made by Messrs. Parkinson and Cowan, Limited, is fixed on the hydraulic main about 6 feet beyond the end of the retort-benches; and from this point, to assist the cooling of the gas, the foul main is returned the whole length of the building, supported by brackets bolted on to the main stanchions of the retort-house. The foul main over the top of the benches is also supported on cast-iron saddles resting on joists fastened to the buckstaves.

The coal-handling plant consists of coal-breaker, twin elevators, a push-plate conveyor, and a hopper running the whole length of the house for feeding the charging machine. The coal-breaker is placed in a pit 14 ft. 8 in. by 15 ft. 1½ in. and 20 ft. 6 in. deep. The foundation of the pit is a concrete bed 18 inches thick; the walls of the pit being built of brick 14½ inches thick set with cement mortar and backed with cement concrete 2 ft. 9½ in. thick at the bottom, and stepped at suitable heights until reduced to a



Charging Stage of No. 2 Retort-House.

Discharging Stage of No. 2 Retort-House.

thickness of 14 inches at the top. A hopper made of wrought-iron plates to guide the coal on to the breaker is suspended on rolled steel joists placed across the top of the pit at a level which enables the coal to be directly tipped from carts into it.

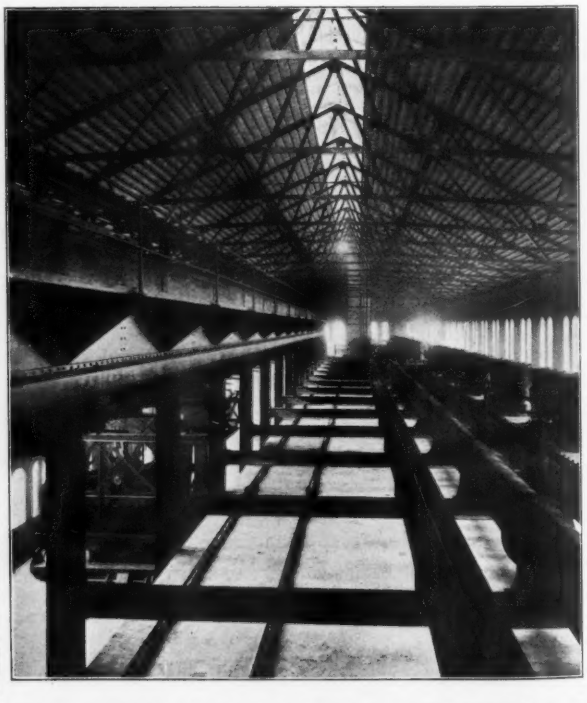
The coal, after passing through the receiving hopper, feeds on to a jigger-screen placed just above the coal-breaker, and so arranged that only coal of 1 inch cube or over has to pass through the breaker, the small material passing through the screen directly into the elevator-boot. The jigger screen obtains its motion from eccentrics connected with the main shaft of the coal-breaker; the latter being driven by a 12½ H.P. electric motor. The coal-breaker is of the double-crusher type, made by Messrs. W. J. Jenkins and Co., Limited, of Retford, and has a crushing capacity of 25 tons per hour.

The coal, after being crushed, passes on to the elevator, and is lifted up to the conveyor in the retort-house fixed at a height of 34 feet above the cellar-floor level. Each elevator is fitted with 66 buckets each 20 inches wide, and 8 inches deep, and is speeded to lift 25 tons of coal per hour. The buckets are attached to a Gibbons patent steel roller-chain; the elevator being encased in a sheet-iron frame of suitable strength and dimensions. The elevators are belt-driven off an 8½ H.P. motor fixed on a platform at the elevator head; but the starting and stopping gear is operated from the stage-floor level.

The coal-conveyor is of the push-plate type, and 158 ft. 10½ in. long. The framework supporting the conveyor is made of an inverted U shape, and is constructed with 4 in. by 2½ in. tees, strengthened with gusset plates in the corners. Angle shoes are fixed to the corners of the frame, and are bolted to the supporting joists which span the hoppers. The frames are strengthened throughout the length of the conveyor by means of 2½ in. by ½ in. mild steel flats, lattice-braced. The push-plates, fixed 19¾ inches apart, are 20 inches wide; and the gauge of the rails on which the conveyor travels is 23½ inches. The conveyor is driven by an 8 H.P. motor fastened to a platform fixed on the top of the hopper at one end of the house. This platform is 5 ft. 5 in. by 3 ft. 2¾ in., strengthened by means of four 6 in. by 3 in. channels fastened to the joists across the hopper. The motor runs at a speed of 1000 revolutions per minute, reduced by three sets of wheels, so that the sprocket-wheel driving the conveyor makes 13¼ revolutions per minute. The speed at which the conveyor travels is 84 feet per minute.

The coal is passed from the conveyor into the coal-hoppers by means of slide doors 4 ft. 9 in. centres along the whole length of the conveyor. The hopper is 160 feet long and 10 feet wide, and holds about 250 tons of coal. It is carried on 16 in. by 6 in. rolled steel joists, supported on brackets bolted, with slotted holes to allow of expansion, on to the main stanchions and to the buckstaves. The top portion of the hopper is rectangular, and is 4 ft. 6 in. deep. The bottom part is 3 ft. 6 in. deep (fig. 3), and the sides are set at an angle of 42° with the horizontal. At intervals of 4 ft. 9 in. throughout its length, the hopper is strengthened by means of a frame constructed of 6 in. by 3 in. by ⅜ in. tees, and 2½ in. by ½ in. flats fixed diagonally. The 34 openings in the bottom of the hopper (through which the retort-charging machine obtains supplies of coal) are formed with iron castings, machine faced, and fitted with doors operated by patent levers. A checker-plate gangway, supported on brackets fixed to the hopper frame, runs along the whole length of the hopper.

A Fiddes-Aldridge machine is used for simultaneously charging and discharging the retorts; and since these machines have been so frequently and so fully described in the Technical Press, I need only add that the one in use in the retort-house under



View taken from the Top of the Benches - No. 2 Retort-House.

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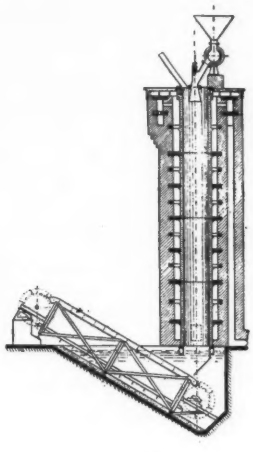

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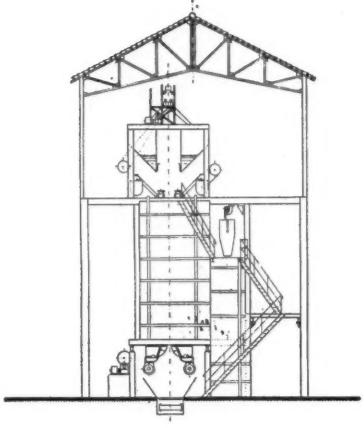

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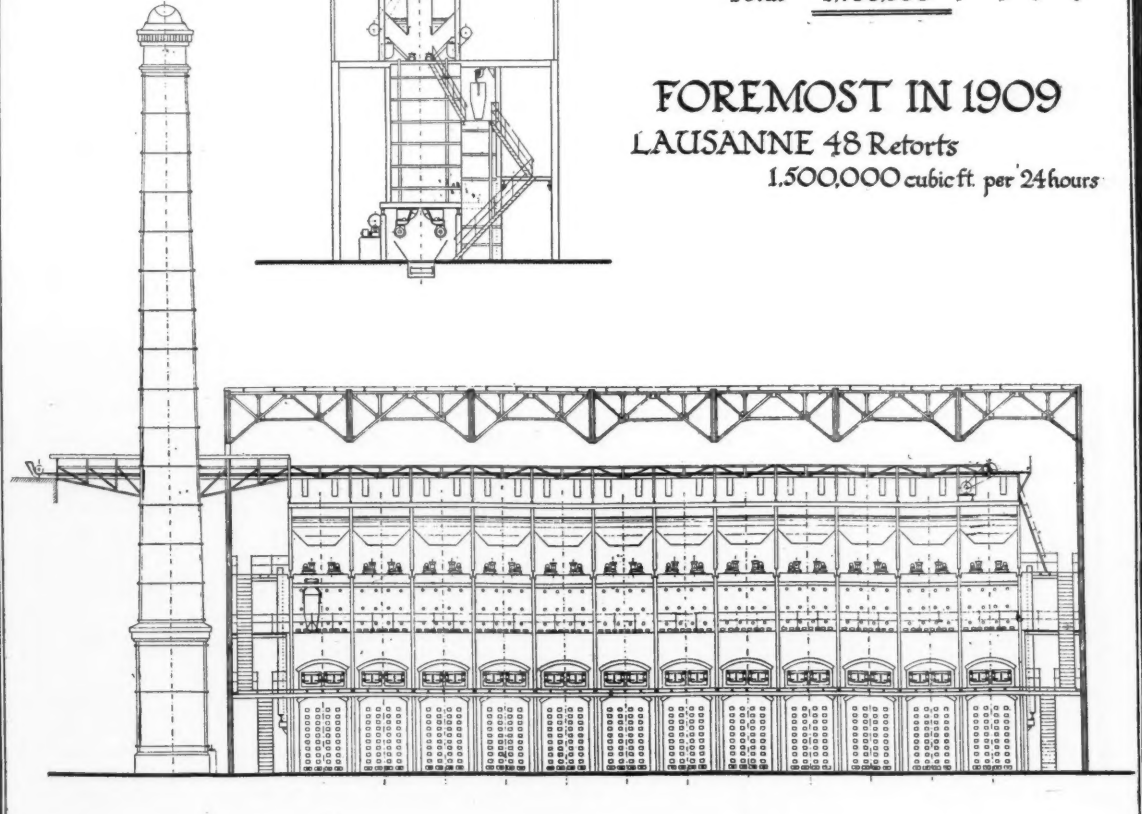

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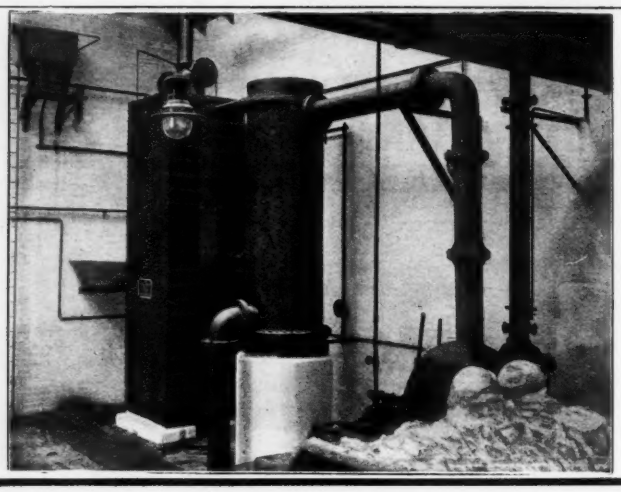

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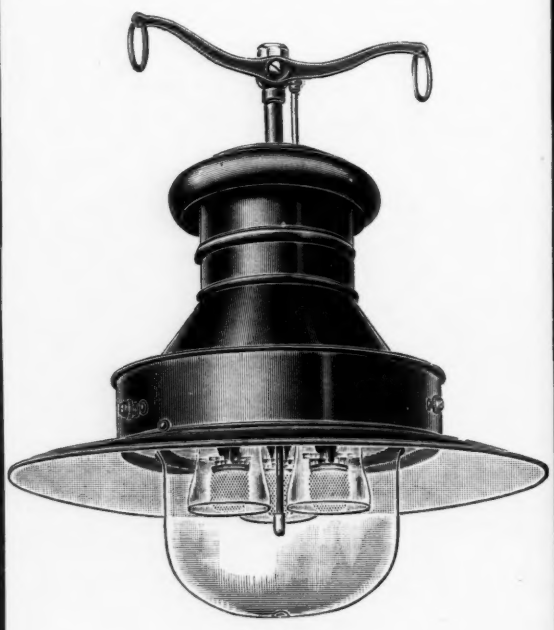

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Electricity is the motive power employed in working the coal-crusher, coal-elevator, coal-conveyor, and charging machine; the current being generated on the works. For this purpose, a 49 B.H.P. gas-engine has been installed which, at full load, consumes 15½ cubic feet of gas per horse power per hour—a total of 747 cubic feet per hour, costing, with gas at 1s. 6d. per 1000 cubic feet, less 5 per cent., 1s. 0¾d. per hour, or 0·26d. per horse power per hour. The engine drives a dynamo which generates 160 amperes at 225 volts, or 36 units of current per hour; and thus at a cost of 1s. 0¾d. for gas, electric current is produced at only 0·35d. per unit.

At other works of the Gas Department, either hydraulic power or compressed air is employed to operate the charging and discharging machines—both the systems having proved economical. The use of electricity at Adderley Street will later enable comparisons of cost to be instituted that must prove interesting and instructive; but the point I now wish to make is that in Birmingham motive power can be obtained by means of gas at a cost of 1d. per 3 H.P. per hour.

In conclusion, I have to express my regret that, as the plant has only recently been started-up, and our tests are consequently not yet completed, I am unable to furnish the members either with results of the cost of manufacture, or the cost of working. I may, however, add that, so far as can be seen at present, we shall be getting from Derbyshire coal well over 11,000 cubic feet of 16-candle gas (tested by the No. 1 "London" argand burner) per ton carbonized, with a very satisfactory yield of coke and other residuals for sale, at a carbonizing cost of under 1s. per ton, which would be still further reduced if the charging machine, instead of being only employed on 96 retorts, could have its full complement of 200 retorts to charge and discharge.

I am indebted to Mr. Walter Chaney, the Engineer-in-Charge of the Nechells and Adderley Street works, under whose supervision the erection of the new house has been carried out, for enabling me to furnish the Association with the information contained in this paper.

Discussion.

Mr. W. S. Smart (Saltley) said that, in the first place, he would like to express his sympathy with Mr. Barber in the very sad event that had prevented his attendance at the meeting. The paper which had been read was most interesting; and he thought additional value was added to it by the fact that it was accompanied by very clear detailed working drawings. They were able to follow descriptions of this character very much more closely when drawings were attached to papers. Mr. Barber's contribution came at a very opportune time, as the members had only just visited Coventry, where they saw the Fiddes-Aldridge machine in operation in a retort-house of a somewhat similar type; and they were thus enabled to contrast the two, and see the variations in the designs. He thought retort-houses of this class would be the strongest competitors in future with the more recent methods of carbonization—such as inclined chambers and verticals—in the inevitable struggle for the survival of the fittest, which had always taken place in engineering work. They were told in the paper that the foundations were put in in lime concrete, and in the depth of winter. It seemed to him that it would be a matter of very serious consideration as to whether it would not perhaps be better, or as well, if these foundations were laid in portland cement instead of lime. Lime depended for its setting on the loss of water and the absorption of carbon dioxide from the atmosphere; and in winter lime concrete took a very long while setting. Portland cement, on the other hand, was independent of these considerations, and set very quickly. Of course, there was a great difference in cost; and the practical consideration was, Are you justified in increasing the cost of the retort-house to obtain these advantages? Steel frame buildings, he noticed, had been adopted in this particular case. As far as Birmingham was concerned, steel frame buildings were an innovation. They had, however, several advantages. Generally, brickwork and steelwork were placed with separate contractors; and where there were two or more contractors working together, delays were always inseparable from the job. One contractor was waiting for another; and there were always excuses. On the other hand, with a building like this, a few blocks of concrete were all that was necessary; and the steelwork contractor could practically finish his contract without waiting for anyone else. The duties of the clerk of works were also much simplified. The clerk of works often required to watch the contractors very closely in connection with large and important constructions. One frequently saw foremen erectors, and such-like, fiddling and messing about with a tenpenny-halfpenny spirit level; whereas the correct thing would be for contractors to send an experienced man with a theodolite and dumpy level to line up and level the work. They often required watching in this respect. With regard to cost, however, he supposed a steel frame building would be more expensive than a solid brick building. He thought, if he rightly made it out—of course, it all depended on the number of openings in the brick walls—it would cost approximately £200 more than a solid brick building. He noticed, too, that there were eighteen principals. He took it that these were intermediate ones, and that there would be an additional principal or steel framing of some description at either end. If not, the advantage of getting clear away with the work would be lost, as the workmen would have to wait before they could fix the purlins on the end bays until the gable walls were all built up. Then he noticed that wind ties were being put in. All the more important engineers used these; but his own opinion was that they were unnecessary in a case like this. Where they had about eighty or ninety purlins on the roof, as here, he thought the addition of a light angle tie was not going to make much difference. Where the purlins were (say) 10 feet apart, or where they had wooden purlins, ties were necessary; but in the present case it did not seem to him that they were. The trough flooring as put in was very good; and, in his opinion, it was one of the best. It was rather expensive; but, still, it made an excellent floor. One of the disadvantages was that it was very awkward for cutting round the U shape for bringing up pipes, or anything like that. But, to his mind, it was much to be preferred to the expanded metal or reinforced concrete which appeared to be so widely adopted at the present time. He saw that tests had been specified for cast iron. Well, his experience of this matter was that they were not often enforced; but if the work was very important, he always thought it was much better to specify that the test bars should be cast and run with the casting. The quality of iron in the foundry cupola (which dealt with relatively small quantities) was constantly changing; and one could not have an inspector at the foundry continuously. It was only by casting the test bars with the casting that one could be sure they correctly indicated the quality of the iron. Steel tests had also been specified; but it simplified matters if in these cases one merely stipulated that the material was to be to British standard, which altogether went into the matter more thoroughly than one could hope to do in a specification such as the one in the paper. This particular specification said all mild steel had under test to show a tenacity of not less than 26 tons or more than 32 tons per square inch, with an elongation of not less than 20 per cent. on a length of 8 inches or more than 40 per cent. reduction of area at fracture. The British standard was 28 tons to 32 tons; and it did not take into account reduction of area of the test bar, while the bending tests also were not so stringent as in this case. With regard to the settings, the drawings showing the section through the waste gas flues and secondary air flues seemed hardly complete in one particular instance. The end walls of the setting from the semi-circular producer arch downwards were omitted; and the baffle-tiles had been carried across the full width of the bed. As shown, they were more or less open to the atmosphere. He presumed, however, there would be blocks or else an end wall to stop up the flues. If there were special blocks fitted in, it seemed there was a lot of space left; and there would be a tendency to draw in air. Then as to the semi-circular main arches of the setting. They were shown to be made of four 4½-inch brick rings; whereas he had been told by experienced retort-setters that it added to the life if the inner ring of the arch was made one brick thick, instead of half a brick. This prevented a tendency to cave in. With regard to the coal-breaker pit, this was given as 20 ft. 6 in. deep, which seemed rather deep for one of this description. The author also said it was 14 ft. 8 in. by 15 ft. 1½ in.; and inspection of the drawing seemed to show that it was wider than it was deep. Possibly there was a printer's error here, and it was really about 15 feet deep. Was there any difficulty found with water? In the case of most of the other works of the department, there had been enormous trouble with water in connection with crusher-pits; and he presumed there would be difficulty at Adderley Street. The drawing said "Canal Side of the House;" and if there really was a canal near, trouble might be expected. Generally speaking, it had been found necessary to render the walls of the pits in cement, and to make the bottom in the form of an invert of an arch, so as to prevent the head of water thrusting it up. In the description given of the coal-hopper, it was mentioned that it would hold 250 tons; but from the dimensions given, it seemed to him that this was a very generous estimate. He did not think that 250 tons of coal could, without much trouble, be got into a hopper of this description, 160 feet long, 10 feet wide, and filled by a conveyor only 20 inches wide. There was not much chance of it getting very full. In fact, after making due allowance for the portions left unfilled, due to the angle of repose of the coal, he could not see how it would be possible to get more than (say) about 160 tons in without considerable labour in trimming. Then, again, the paper said there was a single gas-engine. He would like to know whether, as the result of the working of the plant, it had been found necessary (as was often done) to put in a duplicate engine—as was the case with the elevators. In several places, the author said slotted holes had been put in for expansion. His own experience was that they did not take expansion. There was so much grit that the friction between the two surfaces was too great for much sliding action to take place.

Mr. W. H. Johns (Saltley) remarked that Mr. Smart had dealt so fully with the engineering part, that there seemed to be very little left for him (the speaker) to talk about. As a gas engineer who had had experience of the working of gas-engines, he had always found it necessary to have a duplicate. There were occasions when one got hot bearings; and lately there had been some trouble with countershafts. There were one or two points in the paper he was not quite clear upon. In the first place, the author said that a 10-inch retort-house governor was employed. Did this deal with the whole of the 1¾ million cubic feet made per 24 hours? If so, it appeared to be rather small. At Saltley, on one of the sections with a make of 1¼ million feet a day, they were going to have installed two governors, each

10 inches in diameter—that was, to deal with rather less gas than at Adderley Street, where one was supposed to do the work. If they could do with one governor at Adderley Street, he thought the same provision should be sufficient for Saltley; but he had been given to understand by the makers that it was necessary to have two governors—one to be cleaned out while the other was in action. In retort-houses, they were not working under the best conditions as regarded atmosphere; and the dirt which came in contact with the bell of the governor (unless the governor was enclosed) had been proved to soon eat away the metal. While one governor was under repair, it was, of course, necessary to have a spare one. It was also stated in the paper that the governor was fixed on the hydraulic main about 6 feet beyond the end of the retort-bench. He did not know whether Mr. Barber meant on the foul main; but he (the speaker) was not aware of the hydraulic main overhanging or extending beyond the retort-bench. At any rate, he had never seen one. Mr. Smart had raised the question of the capacity of the hopper. He also wished to refer to this point, but in a rather different connection. The paper gave the capacity of the hopper as 250 tons; and from this it appeared that they had a very good reserve. The coal breakers and elevators were designed for a capacity of 25 tons per hour. They required during the 24 hours, with a make of 11,000 cubic feet of gas per ton, and a production of 1¾ million cubic feet, 160 tons of coal. Why was the hopper designed for 250 tons? Owing to the position of the Adderley Street works, it was necessary to cart the coal, and they probably liked a little in hand in the hoppers; so that the difference between 160 tons and 250 tons no doubt was made up of storage for emergencies. He would like to ask whether they found it requisite to employ a night shift there, or whether, in the design of the hoppers, it was not intended to work a day shift only. Because in well under eight hours, with 25 tons per hour, they would be enabled to get up sufficient coal for the 24 hours. There was another point that struck him as being perhaps rather strange. The tendency nowadays was to put in beds of eight or more retorts. Why they should have gone back to six, he did not know. Probably it was on account of the centres of the buck-staves being only 9 ft. 2 in., and 8-inch ascension-pipes being employed there was some difficulty in fitting in the pipes. He would like to know if this was so. In a paper which was recently read by Mr. Bell, of Derby, he believed it was stated that the centres of the buckstaves were 9 ft. 6 in. in a similar installation; and under these conditions, he was able to get eight retorts in a bed. By working eights in the settings, the machines at Adderley Street should have been employed to better advantage. He was under the impression that these machines could work at their maximum capacity 200 retorts; whereas at Adderley Street the maximum amount of work they could be employed on was 96 retorts. The cost of carbonizing for the 96 retorts was given in the paper as about 1s. per ton. This seemed to him a great deal too high; and he would not be satisfied himself, with a new installation, unless he got down to a much smaller figure. But, as he had pointed out, the machines were only doing half-work at the present time; and if they could have had a little more to deal with, a lower figure should have been reached. At Derby, he believed the figure was 6d. per ton, with De Brouwer machinery. He did not know the exact figure at Coventry, where they had Fiddes-Aldridge machinery; but he believed that it was under 1s. per ton. He had not himself had experience with the Fiddes-Aldridge machine on a practical scale, though he had had acquaintance with it on some old settings before it was adopted actually for gas-works use. He referred, of course, to the first machine, which was erected at Bath. They tried it there on some old beds when it was in the experimental stage. What he would like to know was whether the retorts could be filled—of course, leaving space for the swelling of the coal—so well as could be done with the De Brouwer projector. The filling up of the retorts combined with longer periods of carbonization seemed to be the general practice nowadays where over 12,000 cubic feet per ton could be obtained. Why were the De Brouwer machines not put in in this case? Perhaps it was on account of the number of men necessary to work them—two instead of one. But this would be a very small matter. Besides, they had to look at the actual cost of carbonization; and it did not matter whether there were two men or one, if the ultimate result was satisfactory. It seemed to him that, with longer periods of carbonization and filling the retorts completely, better results could be obtained. Of course, these were heavy charges, because the retorts were large; but he did not mean that. What he meant was the filling of the retort as far as possible. It would have been very interesting indeed if Mr. Barber could have given them some idea of the cost of the installation, leaving out the walls and the roof. They might not all be content to put in steel structures with brickwork panelling. Some of them might prefer to build the walls of solid brickwork; and therefore he thought the comparison of the walls and the roof should be left out. He would have liked to have known the cost of the installation, so that it could have been compared with a similar installation of vertical retorts. There was another thing in the paper that was not quite clear to him—that was, the method of removing the coke. Was there any difficulty in quenching the coke in these bogies? No mention was made of the capacity of the bogies; but from what he could see on the drawing, compared with the distance between the coke floor and stage floor level, which was given as 10 feet, the bogies would be about 5 or 6 feet deep, and 3 or 4 feet wide. The length he was unable to get from the drawing. He should say that there would be a large quantity of coke contained in such a bogie, and that there would be some difficulty in quenching it. Did the author find that there was any deterioration in the coke? To his (the speaker's) mind, it would become slightly burnt before it was removed from the retort-house. There was no mention in the paper of the make of the retorts. He took it that Stourbridge material was employed.

Mr. A. Hancox (Great Malvern) said Mr. Smart had made some remarks with regard to lime and cement concrete. He (the speaker) thought the extra cost of the cement concrete would be more than repaid by its use. In the first place, it was difficult to get lime concrete to set. Often some months after lime concrete was put in, there was found to be a great deal of moisture in it. For this reason, he thought they would find that with cement concrete the foundation would be much strengthened at the early stage of putting up the building when the weight came upon it. As regarded the cost of steel framing and solid brickwork for retort-houses, he would point out that in the present case had solid walls been put up they would have had to be much thicker; but for steel framework the thickness was ample. With reference to the wind ties, there was an old and a true saying that "Prevention is always better than cure." He thought it was highly advisable in every case that wind ties should be added. Mr. Smart had remarked that the depth of the coal-crusher pit seemed to him excessive; but perhaps they had been guided a great deal by the crusher and elevator. At Malvern they had a deep hole to tip the waggons into. They had a hopper that held 10 tons of coal at one tip; and in that case the hopper hole would run about 23 feet deep to the bottom of the boot. He thought probably they would be guided to some extent by the amount of coal they wanted the hopper to hold, and also by the crusher. He would like to ask Mr. Barber if he did not think it would be better to have a cavity in the main arch between the two rings of 4½-inch fire-brick and the two rings of red brick. He agreed with Mr. Smart as to the advisability of having one 9-inch ring of fire-brick, instead of two rings of 4½-inch brick, for the inner ring of the main arch. Also in the combustion chamber he noticed there was a segmental arch, which undoubtedly must throw some side-thrust on to the bottom retorts. He thought in time Mr. Barber would find that this thrust would tend to push the sides of the retorts in and deform them. A semi-circular arch would overcome the difficulty.

Mr. Owen Evans (Wrexham) remarked that the paper was particularly interesting to him because they had had a retort-house of this description in use at Wrexham for two years, though they did not carbonize anything like the same amount of coal as in Birmingham. The first point he wished to refer to was the position of the ascension-pipes, which were fitted on the discharging side of the house. At Wrexham, they had them on the charging side, which he thought was the better position, because with this type of machine the discharging stage was a lot hotter than the charging stage, and the coke dropping in front of the ascension-pipes tended to keep them hot. The other side was cooler; and, in addition to this, placing the ascension-pipes there made a better distribution of labour, as the man there did not have so much to do, and was therefore more able to look after the ascension-pipes than the man on the discharging side. He would like to know how many men were employed per shift. He would prefer to use portland cement, which was what they put in at Wrexham. As to the number of retorts in a bed, they had sixes at his works.

Mr. R. Wardell (Birmingham) said he noticed the 9-inch intermediate walls were not carried up to the main arch. He referred to the portion immediately above the top retorts. From his experience of discharging machines of the push type, this had been found necessary. That was to say, to build a 9 in. by 9 in. pier from the top of the retort to the underside of the main arch—leaving sufficient space for the free passage of the furnace gases. When working on new retorts, there was practically no trouble; but with old retorts that had sagged and lost their shape, charges when pushed out would occasionally buckle and wedge, with the result that, when retorts were not strengthened in the way he had mentioned, they were liable to displacement. Of course, the circuit-breaker on the discharger could be made to blow readily, and so prevent damage being done; but if the precaution he had named was taken, the circuit-breaker could be more heavily weighted. In a large house where one discharger was dealing with (say) 200 or 250 retorts, time was an important matter; and they could ill-afford to lose it through the circuit-breaker blowing freely on an old set of retorts. The Fiddes-Aldridge machine seemed to him to be putting "all one's egg in one basket." In the event of it breaking down, both charging and discharging were dislocated for the time; but with the De Brouwer machinery, if either the charger or the discharger broke down, there still remained one operation that could be gone on with. It was also important to be able to fill the retorts right up, which could undoubtedly be accomplished with the De Brouwer machine. With reference to gearing, it was stated in the paper that "the motor runs at a speed of 1000 revolutions per minute, reduced by three sets of wheels, so that the sprocket-wheel driving the conveyor makes 13¾ revolutions per minute." If a motor had been installed in the first place speeded at a lower rate, the initial cost would have been greater; but the continuous loss of friction would have been saved.

Mr. Hancox said he should like to refer to a remark that had

been made to the effect that two retort-house governors should be installed, so that one could be working while the other was undergoing cleaning. At Malvern, they had had Braddock's retort-house governors for nearly two years. They had two; and they wanted occasionally to be cleaned out. He had periodically changed them over and taken out the bell; but the whole time they had been in, he had not had a handful of tar, or anything more than would run from the outlet at the bottom.

Mr. G. C. PEARSON (Birmingham) remarked that, with regard to the settings, the point that struck him was that there seemed to be no arrangement for distributing the primary air. It all appeared to go in through the clinkering door. It would be much better if there was some arrangement for the distribution of air under the fire-bars. To his mind, there was very little danger of retort-house governors getting out of order or wanting cleaning. They had had one working for two years in connection with the coal-testing plant; and it had not been out of order in any way. They found it necessary to fix an automatic syphon at the bottom to run off the tar that collected there, and also to arrange a run-off to the reservoir. A little tar seemed to adhere to the sides of the governor-valve, and run down to the reservoir, and cause the valve to stick somewhat. The automatic syphon kept everything quite clear. Of course, one always arranged a retort-house governor in such a manner that it could be bye-passed for a short time if necessary.

The PRESIDENT (Mr. A. O. Jones, of West Bromwich) voiced the great regret of the members at Mr. Barber's absence that afternoon, and its cause. He said it was in deference to Mr. Barber's wishes that they had the meeting at all. There was some idea of postponing it until he could be present and reply personally to the discussion; but Mr. Barber seemed to desire that the paper should be read. He would see the report of the discussion, and would no doubt reply to it through the medium of the Technical Press. Turning to the paper, he would like to know why such a small number as six retorts in a bed was adopted. The use of machines on one side of the bench only showed to advantage in the construction of the retort-house. With the arrangements adopted, it seemed possible to reduce the width of the retort-house by about 15 feet, which represented rather a large economy of space in building a new house. In this instance, 170 cubic feet of gas was produced per square foot of area per 24 hours, which was very high. The size of the retorts was 25 in. by 15¼ in. by 20 feet long; and from this basis he worked out the size of the charges. Taking 1¾ million cubic feet per 24 hours as the production of the house, and 11,000 cubic feet as the make per ton, it came to nearly 10 tons per setting; and with a make of 11,500 feet, to about 9·5 tons per setting. This worked out for eight-hour charges would be about 10½ to 11 cwt.; and for six-hour charges, about 8 to 8¼ cwt. This was a very heavy charge; and he did not know how they managed to get it. As to the silica work which was continued to within 3 inches of the top retorts. He supposed that would give it a longer life; and if this was so, why did he not have his retorts made of silica as well? If he took his retorts out, he would have to take his division-walls out to do it; and so there would not be so much economy as by having silica retorts as well.

At a recent meeting of the Paris Academy of Sciences, M. Witz dealt with the subject of the regeneration of the exhaust gases from internal-combustion motors. The author suggests that the exhaust gases, taken from the cylinder without cooling, should be passed over a column of incandescent coke. The gas thus produced, containing carbon monoxide, is washed and re-admitted with pure oxygen to the gas-engine cylinder. It is assumed that the price of the oxygen, prepared from liquid air, is now sufficiently low for use in this manner commercially. The utilization of the heat in the exhaust gases is calculated to give an economy of about 30 per cent.

It has frequently been said that a busy man finds rest not by abstention from work but from change in the character of his occupation. The remark appears to be particularly applicable to Mr. Samuel Wood, whose retirement from the firm of Messrs. Wood, Drew, and Co. was announced in the "JOURNAL" for the 13th of July last. On his release from professional duties, Mr. Wood went to live near Bournemouth; and evidence has just reached us that he is still by no means idle. When busily engaged with accountancy work, he must have found recreation in the study of philology, for he was able, at the weekly meeting of the Exeter Literary Society on the 2nd inst., to discourse for an hour and a quarter, without notes, on "The Growth of the English Language." The thorough knowledge of the subject which Mr. Wood displayed could scarcely, we should imagine, have been acquired in the leisure he has had since his retirement; and therefore we must assume it was the outcome of many hours previous study by way of recreation. He explained how, by philological evolution, from the 800 words which sufficed for the tribes whose representatives came to Europe in past ages from the mysterious depths of Asia, has sprung all the enormous variety of thought and marvellous power of language of the present Indo-European tongues. By the aid of lantern slides, he showed specimens from the old writers, from King Alfred to the Elizabethan Bible, to illustrate the changes which the language underwent from century to century. At the close of the lecture, the Chairman (Mr. W. N. Westlake, of Exeter) proposed a cordial vote of thanks to Mr. Wood.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

Visit to the Alloa Corporation Gas-Works.

Last Saturday afternoon the members of the Eastern District Division of the Scottish Junior Gas Association paid a visit to the gas-works of the Alloa Corporation. The day was pitilessly wet, and in consequence the attendance was disappointingly small—numbering only about twenty. Provost Duncanson, Councillor Mitchell, and Mr. J. W. Napier, the Engineer, received the visitors; and by these gentlemen and Mr. A. Kelloch, the Assistant-Manager, they were shown round.

In the retort-house there is a single bench, containing 14 ovens, in 11 of which there are settings of eights, and in the rest settings of sixes, back to back, and fired on a regenerative system. The charging is done by a De Brouwer machine, which has been in use since the end of 1905. On inquiry, Mr. Napier stated that the first rubber belt upon this machine lasted a year and eleven months, and charged about 25,000 tons of coal. The present belt has been more than a year in use. As was explained at the time the machinery was inaugurated, the two sides of the retort-bench are served by one machine, which is made to travel round the end of the bench. The motive power is electricity, which is generated on the works; Alloa being the first place in Scotland where electricity was employed for driving gas-works machinery. The drawing is done by hand; the coke being raked out into barrows which are wheeled out by men to the yard, and the quenching being done on the way, under a tower. The system of handling the coke is about to be superseded by a more up-to-date one; plant for this purpose, costing about £2000, being all but completed. The drawing will continue to be by hand; but the coke will be received in skips running upon rails in the underground chamber of the regenerative arrangement. The skips will be hoisted to a Telpher railway, which will convey them to a couple of hoppers, each of 10 tons capacity, or to the yard. Before reaching the hoppers, the skips will travel over the flat roof of the engine-house, upon which are placed two cast-iron tanks, 9 feet square and 6 feet deep, into which the skips will be lowered for the quenching of the coke. Below each of the hoppers, screening plant, to be driven by steam, is being fitted up; and a bagging appliance, to be served from either hopper, is provided. The plant is being supplied by Messrs. W. J. Jenkins and Co., Limited, of Retford. For the working of the De Brouwer machine, as well as the coal breaker and elevator, a 25 H.P. "National" gas-engine, coupled direct to a dynamo, has been in use. To work the new plant, an addition has been made to the power plant in the shape of a 40 H.P. gas-engine of the above-named type and a dynamo of 20 kilowatts capacity, which will work two motors, one of 11 H.P. for elevating the coke and the other of 7 H.P. to work the Telpher railway. It should be stated that a Parkinson and Cowan 10-inch retort-house governor was fitted up some time ago, and has proved a highly effective instrument.

Coming to the purifying plant, an Everitt tar-extractor has been in operation for some months, and by its use the naphthalene trouble has been considerably reduced, although not altogether eliminated. The gas is washed by a Livesey washer and a Holmes washer-scrubber, each of a million cubic feet capacity. The exhausters, in duplicate, are Waller's, one being of 30,000 cubic feet capacity, and the other of 40,000. Purifying is effected by oxide only, in four boxes 20 feet square. Only one sieve is employed; the material being filled to the top, a depth of 39 inches. In the purifying process 2 per cent. of air may be introduced, as required. The purification costs last year, for 121 million cubic feet, amounted to £46; being at the rate of 0·09d. per 1000 cubic feet of gas made. The quantity of gas passed through the purifiers before changing has been as high as 134 million cubic feet; and the purifiers have not been changed for fully twelve months. The purifier-house is lighted by electric lamps, which can be lowered into the boxes. An overhead runway extends into the yard, and on it skips containing 10 to 15 cwt. are run by hand.

The gas supply to the town is governed by a Cowan water-loading governor. The night pressure is 4 inches, and the day pressure as high as 3 inches. There are two district governors; one for serving the Clackmannan district, and the other one the Cambus and Tullibody district. The lighting of the works is most effectively done by high-pressure inverted incandescent gas-lamps, similar to those in use in Fleet Street. For their service a very small Keith compressor, working up to 54 inches, is placed in the exhauster-house, and is driven by a belt off the exhauster shaft. Beside it is a switchboard, upon which the lamps in all the different departments about the works can be turned on or off; ignition being effected by an electric spark.

Mention has been made of the out-districts which are supplied with gas. One of these is about three miles to the east, and the other about the same distance to the west of the town. In the one to the east there was great difficulty in maintaining an adequate supply of gas, and after leaving the gas-works a visit was paid to the town station, where the members were shown an arrangement for boosting the gas supply, which has been found to work very satisfactorily. A small Bryan Donkin exhauster, worked by an electric dynamo, is used to compress the gas. The machine is capable of compressing up to about 10 inches. With an inlet pressure of 3½ inches, it is being worked so as to compress up to

6½ inches; and at the entrance to the district the gas is governed down to 4 inches.

In the course of the visit, Mr. Napier explained that in one part of the area of supply great trouble was experienced on account of the cast-iron mains being broken in consequence of underground workings; and that he had, with good effect, laid Mannesmann steel tubes in the district. He had also, he said, on account of the costly street paving which is now the fashion, adopted the practice of laying these tubes for all service-pipes, as they are found to be capable of withstanding more pressure from road-rollers; and as they have a life double that of cast-iron pipes, there is less occasion with them for opening roadways. It should also be mentioned that in a corner of the now all but disused lime-store a bathroom for the workmen has been fitted up in which water is heated by the exhaust steam from the engine that drives the washing and scrubbing plant.

After the inspection, the visitors were entertained at "high tea" in the Royal Oak Hotel.

Provost DUNCANSON, who presided, extended a welcome to the Association. He said the gas undertaking was one of the most valuable they had. The original capital when the Corporation took over the gas-works in 1877 was £25,000; and the capital now at the debit of the gas-works was no more than £32,000. The members would, he thought, agree with him that the works had been conducted in a most economical and efficient way. They had been very well served by their Managers. He need not speak of Mr. Napier, whom they all knew; but his immediate predecessor—Mr. Yuill—was a man of outstanding ability. Mr. Napier, however, did not fall below the standard of Mr. Yuill. He might tell them that any proposition made by their Gas Managers, which was likely to be for the benefit of the undertaking, was adopted without hesitation.

The PRESIDENT (Mr. H. Rule, of Falkirk), on behalf of the Association, expressed their thanks to the Corporation for their kindness, and also their appreciation of the honour done them in having Provost Duncanson and Mr. Mitchell there to welcome them. With regard to the works they had seen, he thought they could say that, though they were not new, their efficiency was almost equal to that of new works; and also that they were being kept up to date, as witness the alterations which were going on in connection with the coke-handling plant, and other minor constructional work. He felt sure the members had received many little "wrinkles" which they might adopt. They were also very much indebted to Mr. Napier for giving them all the information possible about the works.

Mr. MITCHELL said the gas-works at Alloa were a wonderful institution. They came into the hands of the Corporation some thirty years ago, when the annual output was about 20 million cubic feet. The capital value of the undertaking now, after all these years, was only £8700 more. This was very good business indeed. As an industrial concern, there was nothing in Alloa that gave a better return than the gas-works. The visitors might think they were in the midst of the coalfield; but nine-tenths of their whole supply of coal was brought to them by rail. They had always endeavoured to write off their capital. About fifteen years ago they spent £5000 on cookers, and in ten years they wrote all this off. Their sinking fund, and the method they had adopted with it, had been very satisfactory. There was one thing, however, which they had been afflicted with during the last two or three years, and that was the electric light. They had had upon this a deficit of nearly £5000 a year. The Council had now arranged with the Electric Plant Company to break their agreement, pay them an indemnity, and take over the lighting. They had resolved to put down plant of their own, and to supply electric current direct; and he had no doubt that in a few years' time, from their method of writing off value, they would be able not only to show a clear asset, but to make a profit. The output of gas in Alloa—121 million cubic feet—was very large for the population, which numbered only 12,000; but they must remember that they were in a centre of industry, and also that there was a great deal of gas consumed by those who used it for power. They supplied gas for this purpose at 1s. 6d. per 1000 cubic feet, which induced the use of gas, and also helped to keep out suction-gas plant.

Mr. NAPIER expressed his pleasure at having the Association of Junior Gas Managers at Alloa. It was a great benefit indeed to the younger generation of managers to go about visiting works, thereby creating in their minds a wider and a fuller knowledge of their profession. Mr. Mitchell had done well in paying a tribute to the Corporation management of the gas undertaking; but there was one aspect of Town Council management in Alloa as regarded gas affairs of which he wished to speak well. This had reference to the disposal of their profits. Some corporations, more particularly in England, had brought a considerable amount of calumny and guilt upon their heads by using the profits from the gas-works in reducing the rates. He was a strict and strong opponent of taking any profits whatever from the gas department for helping the rates; and the Town Council of Alloa had shown great wisdom in not doing so. If it were wished to confer an advantage, it could very well be done by reducing the rate charged for public street lighting. In Alloa they had reduced the rate for public lighting by 3d. per 1000 cubic feet. By the method he recommended, there would be the further advantage to the gas undertaking that it would place it in a stronger position, from a competitive point of view. In Alloa, they had a very large consumption of gas for their population; and it had undoubtedly arisen from the very low price of gas for some years past, and from the advantages they had given in connection with the use of cookers. They had 4300 consumers, and no less than 2300 of them were on their books as having cooking appliances of one kind or another. As regarded power purposes, they had reduced their rate, and had thereby obtained a very considerable increase—from 16 to 20 million cubic feet, or about 16 per cent. of the total. They might be said to have absorbed to a considerable degree the possible consumption of gas; but the Gas Committee were in negotiation with two railway companies with regard to a supply for lighting railway carriages, and they hoped to be able to come to terms with them. The system that would probably be adopted would be that the railway companies would send their tank-waggons to have gas pumped into them, under a pressure of 100 lbs. per square inch. It was exceedingly interesting to know this, because it showed that coal gas was going to have a further use as regarded the lighting of railway trains. He perhaps ought to mention that the annual consumption of gas in Alloa, per ordinary consumer, was 28,600 cubic feet; per slot-meter consumer, 15,600 cubic feet; and per gas-engine, no less than 196,000 cubic feet. Mr. Napier referred to the following table as illustrating the progress of the gas undertaking:—

Capital Expenditure.

Year.	Total Capital Expenditure.	Gas Made.	Capital per Million Cubic Feet of Gas Made.	Capital per 1000 Cubic Feet of Gas Made.	Total Capital Charges (Interest and Sinking Funds).	
					Amount.	Per 1000 Cubic Feet Made.
	£	Cubic Feet.	£ s. d.	s. d.	£ s. d.	
1902	32,241	88,602,200	364 0 0	7 5·33	2073 3 9	5·61
1903	31,966	97,040,400	329 10 0	6 7	2348 9 8	5·79
1904	32,391	96,377,700	336 2 0	6 8·60	2510 11 7	6·24
1905	33,466	102,297,500	327 3 0	6 6·50	2696 9 9	6 30
1906	36,291	109,757,100	331 5 0	6 7·30	2809 9 6	6·14
1907	36,356	114,558,300	317 7 6	6 4·10	3106 3 0	6·51
1908	35,681	118,195,300	301 17 7	6 0	3198 19 8	6·50
1909	33,706	120,978,500	278 12 3	5 6·80	3168 0 7	6·28

In conclusion, he remarked that they were very well off indeed as regarded obtaining the largest possible return for their capital outlay; and he wished to say, as an official of the burgh of Alloa, how well treated he was, and always had been, by his Committee. They worked on quiet lines—those which, he believed, made for the best results.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Members of the Yorkshire Junior Gas Association gathered in goodly numbers on Saturday, at Bradford, to a meeting the character of which was an experiment by the Council.

Seeing that the main purpose of a Junior Association is purely educational, and that therefore it is not only possible but most desirable that well-known and even threadbare topics should be handled, it was decided to make the meeting a private and non-reported one. It was hoped that under these circumstances a freedom in question-putting and answering would be indulged in which could hardly be hoped for in the blaze of full publicity, and that more retiring and reticent members would be thus induced to come forward to the help of their comrades. Confidence thus attained after initial breakings of the ice, might eventually show itself on full-dress occasions in the shape of speeches or papers prepared for publication. Then, as juniors have in many cases gained all their experience on one works, the source of their knowledge can thus be identified, and some gas organizations therefore view the public utterances of the junior members of their staffs with no large amount of favour. The discretion thus implicitly imposed finds its readiest realization in silence. At the same time it must be acknowledged that the work of the various Junior Associations has justified the general approval, interest, and help that they have received. The work would have been in the main impossible but for the friendliness and assistance of the Press and of the gas engineers of the country; and this has been repaid, at least partly, in judicious reticence on the private details of the gas-works represented, and the sterling merit and value of the contributions submitted at the meetings.

Still in many cases members have longed for the greater freedom and the wider opportunities of gaining and giving help that more private meetings would afford. It has been pointed out, for example, that most have had experience of sudden emergencies and difficulties that had to be promptly met, with perhaps limited or even meagre appliances. How crises were tided over might prove ultimately of great value to others who hear of them; but in many cases those concerned would show hesitation in pouring their troubles into everybody's ears through a press report.

Though such semi-private meetings with the usual regulation of debate greatly relaxed need not be regarded as a normal meeting of Junior Associations, it was felt that, as a possible new means

of increasing their usefulness, the experiment was well worth trying. On the present occasion, these expectations were fully realized. Under the somewhat informal conditions prevailing, the time passed quickly; contributions flowed freely; and the members finally expressed themselves as greatly profiting by what they had heard.

One of the members gave an explanation and demonstration of the Orsat gas analysis apparatus, followed by discussion and questions. Then followed discussions on "How and Where to Introduce Air for Oxide Revivification *in Situ*" and "The Conditions of the Official Testing of Meters." Each was introduced by a short paper and was freely discussed. One, at least, of these contributions is, by request of the members present, to be expanded to a full paper for publication in the near future. The meeting ultimately closed by lapse of time, and not by any exhaustion of interest or supply of speakers.

NEW GAS-WORKS PROJECTED FOR THE SUBURBS OF VIENNA.

The Corporation of the City of Vienna have recently invited tenders for the supply of the plant required for the new gas-works to be constructed at Leopoldau. The works will take over the supply of gas to the suburban districts of Vienna now supplied by the Imperial Continental Gas Association.

For the carbonizing plant needed, four firms tendered; and the tender of the firm of H. Koppers, of Essen, and their co-adjutors the West Bohemian Fire-Clay and Kaolin Works, has been accepted. It is for an installation of horizontal carbonizing chambers or ovens, with regenerative furnaces and central producers, of a total productive capacity of 7,400,000 cubic feet of coal gas per diem. The plant is to be equipped with special arrangements for the very thorough extraction of dust from the producer gas with a view to avoiding the injurious effects (specially noticeable with the coals commonly carbonized in Vienna) of the blown dust on the brickwork of the setting. The cleaning of the producer gas will also render it available for use in gas-engines for driving apparatus on the works. The amount of the tender is £136,800. The Contractors guarantee a make of gas equivalent to 11,483 cubic feet, at 60° Fahr., 30 inches barometer, and saturated, per ton of coal, working with a positive pressure of 7·9 inches of water. The average gross calorific power of the gas to be not less than 570 B.Th.U. per cubic foot. If the coal used contains more than 8 per cent. of ash, a corresponding deduction is to be allowed from the guaranteed make of gas. The fuel consumed in heating—reckoned in terms of dry coke containing not more than 11·4 per cent. of ash—is guaranteed not to exceed 12 per cent. of the weight of coal carbonized, inclusive of coke consumed in producing the steam required in the producers and for the power for operating the dust-extracting plant.

A similar plant, of a productive capacity of 1,765,000 cubic feet per diem, will come into operation at the Corporation gas-works at Simmering (Vienna) by the autumn of next year. Four Beale exhausters, each of a capacity of 210,000 cubic feet per hour, driven by steam-engines, are being supplied to the new Leopoldau works by the Berlin-Anhalt Engineering Company, and two station governors by the firm of Franz Manoschek, of Vienna.

Placing Landing-Blocks under an Old Gasholder.

Our readers are aware that one of the features of meetings of Gas Associations on the other side of the Atlantic is the presentation by various members of a number of useful hints, called "Wrinkles." One submitted at the last annual meeting of the American Gas Institute was by Mr. V. L. Elbert, the Works Superintendent of the St. Paul Gas Company, who described to his colleagues how he raised the inner lift of an old gasholder (let down for the insertion of an additional inlet-pipe) in order to place new rest-stones in position and raise the centre pier. The method adopted was as follows: The holder and tank had been thoroughly ventilated; and after work had been completed on the new inlet-pipe, water to the depth of a foot was run into the tank. Three men entered through the manhole, and a manhole cover of wood, with a heavy light of glass, was placed on the opening and bolted down in place of the regular manhole cover. A ¾-inch hose was connected to the crown sheet on the under side to a ¾-inch pipe nipple through the sheet, and a hose with a valve attached to the same nipple on the outside of the crown sheet, which answered as a speaking-tube communicating with men inside. Air was then pumped into the holder with a small plunger air-pump, connected to a 3-inch flange on the crown of the holder; and when the holder was at the proper height, the landing-stones were placed on beds of dry concrete mortar, and levelled from the water level in the pit. The glass in the manhole furnished enough light to get round in the pit; electric flashlights being used to furnish light to do the work. The job was all completed in 3½ hours from the time the men entered to their exit from the holder, with no evil effects whatever. The glass cover could have been broken for the quick release of the men had they desired it.

REGISTER OF PATENTS.

Purification of Ammonia Spent Liquor.

RADCLIFFE, J., of East Barnet.

No. 16,924; Aug. 12, 1908.

In the course of his specification, the patentee says: It is well known that ammonia spent liquor, which consists of water containing in solution lime and its compounds, organic matter in various conditions—notably phenols, cyanogen compounds, and other bodies—is a waste substance for which it is difficult to find a use, and that it constitutes a nuisance in that it cannot be disposed of without injuriously affecting sewage treatment, or water courses and the like, wherever its ultimate destination may be. Further, the water, were it not contaminated, would be of value for steam raising and other purposes. Certain previous inventions have had as their object the purification of ammonia spent liquor in order to permit of its discharge to sewers without harmful effect, and which inventions have been successful. It has also previously been proposed to treat ammonia spent liquor in order to allow of its use for steam raising; but the methods adopted for this purpose have been expensive. It has not, however, hitherto been proposed to remove from ammonia spent liquor phenoloids—phenols, cresols, tar acids, and the like—and the present invention has for its object the removal of such bodies in a simple and inexpensive way; the process being such that cyanogen compounds can be removed at the same time. Valuable bye-products constituting actual impurities of the liquor are thus removed, and may be recovered by condensation or otherwise.

It is well known, he continues, that, upon the acidification of alkaline solutions of phenoloids, the phenoloids are liberated; and he takes advantage of this in carrying out his invention, according to which the removal of the phenoloids and cyanogen compounds from ammonia spent liquor is effected by acidifying the liquor by streams of gases or by strong acid, or a combination of the two. The impurities liberated are, in either case, carried away by intimate contact and/or repeated treatment with gases which need not necessarily be those used for acidifying the liquor. To promote the removal of the liberated impurities, it is preferable that the gases should be hot.

The most convenient gases to employ consist of carbonic acid combustion gases, and the like, as these are easily obtained hot, with the advantage that lime is precipitated, as is well known. Gases of this character may be used solely for acidification, and the liberated impurities carried away by a stream of inert gases, preferably hot, such as air, or a mixture of air and steam; or a strong acid alone may be used for acidification, or a combination of a strong acid and an acidifying gas. It is not advisable to employ reducing gases—for example, sulphurous acid—as by so doing the oxygen absorption test would be raised, and the reduction of this test is one of the principal effects of the treatment forming the subject of this invention.

It is advisable that the materials employed (principally strong acid and waste liquor) should be added in the proper proportions continuously and with regularity, as may be done by known means.

It is obvious that while carbonic acid will liberate only phenoloids, a strong acid, such as sulphuric acid, will liberate not only these bodies but gaseous compounds of cyanogen as well.

The repeated treatment and intimate contact, or a combination of both, may be effected by means of apparatus consisting of a series of scrubbers, or of one scrubber, arranged so that the liquor may successively pass through one or the series, or apparatus may be provided for successive treatment similar in ambit to that of the ordinary ammonia still. If scrubbers are used, it is advisable to have them standing in a tank, or arranged so that the tank bottom is some distance below the liquor level sealing the scrubber, so that the precipitate of carbonate of lime formed where combustion gases are used may fall away without choking the liquor outlets. The liquor may be sprayed or broken up by splash bars, and, if desired, atomizing by a jet of air may be employed.

The liquor, after purification, may be used for coke quenching, steam raising, scrubbing, and other purposes, or it may be treated in any other way. The exit gases may be condensed or otherwise treated for the recovery of bye-products.

Controlling Devices for Lighting Systems.

ANDERSON, D., of Farringdon Road, E.C.

No. 24,246; Nov. 11, 1908; No. 10,706; May 5, 1909.

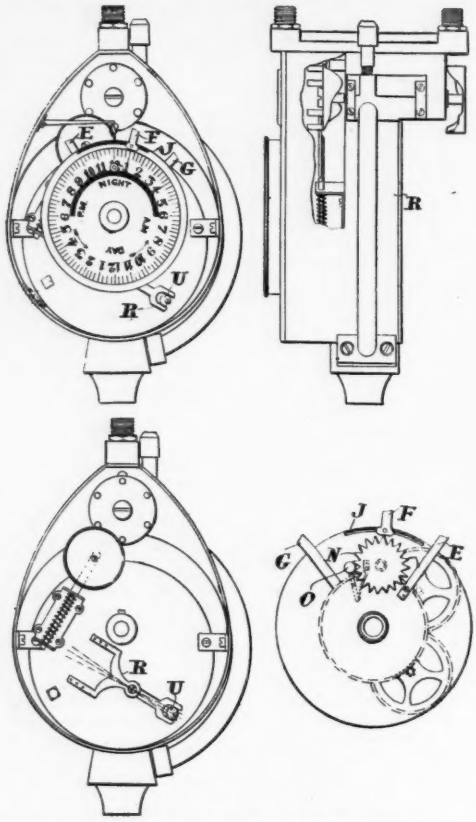
This invention relates to means whereby the lighting system may, at predetermined periods, be automatically adjusted to suit certain temporary requirements, and more particularly to devices of the type indicated in patent No. 27,849 of 1904.

The illustration (p. 756) represents one form of apparatus according to the invention—in front elevation, with the front cover removed; side view, with a portion of the casing broken away to show the fluid control valve; and front elevation of the controller, with the dial and tappet adjusting mechanism removed.

Where it is desired to control two burners in such a manner that, at a predetermined time, both shall be lit, at another time one of the two shall be extinguished, and at another later period the remaining light shall be extinguished, the mechanism employed may be an ordinary eight-day clock movement. On the main arbor (which revolves once in 24 hours) are mounted the dial and timing tappets E, F, and G. Behind the dial is a disc (also mounted on the arbor) having a slot J cut through it at a short distance from its circumference, and parallel to it, and within which at any place the tappet F, which extends beyond the disc and is provided with a set-screw, may be clamped. The slot extends over some three or four hours range on the dial face—this particular tappet being the one whose function it is to extinguish one set of lights; this period of three or four hours being the normal range within which such a function is to be performed.

The two other tappets, E and G, extending beyond the circumference of the disc, are mounted upon sleeves on the arbor at the back of the

disc, and are connected to one another through a train of gearing, one member of which carries a star-wheel N, provided with a click O to prevent vibration from causing it gradually to turn when not desired. The axis of the wheel N is extended to pass through the disc and clock dial, and has a squared end with which a watch key may be engaged, as desired. Each of the two adjustable tappets E G may have at its outer extremity a member having a slot concentric with the disc and having a tappet and set-screw engaging with them—thus allowing of adjustment of one of the tappets without the other, or one of them relatively to the other without using the train of gearing.



Anderson's Lighting Controller.

This whole mechanism, being upon the back of the dial and facing in an opposite direction, will, it is evident, travel over the face of the casing in which is placed the clockwork, and from which the main arbor projects. Upon the face of the casing is provided a forked member R, the distance between the two prongs of which is greater than the diameter of the wheel N. The fork is pivoted about the shank; and its further extremity is also forked to co-act with a cam U, whereby the pins upon the prong of the fork may be caused to bear upon either one side or the other of the wheel N, as it is brought round by the rotation of the disc, or the fork may be maintained in a neutral inoperative position. The cam U may either be actuated by hand, as desired, or it may be automatically actuated by a cam surface on a gear wheel operated by the clock train.

The controller operates as follows: The central tappet F having been set opposite the hour on a clock dial at which it is desired to extinguish one of the two burners of the system, and the other two tappets E and G having been set to the hours at which it is desired to light the burners or totally extinguish them, the clock dial is moved until the hour of the day at which the setting is being performed is opposite to a finger A on the casing, when it is rigidly clamped to the arbor of the clockwork and commences to rotate with it. By means of the forked member, once in every rotation of the dial, the star wheel N co-acts with the pins on one prong of the fork, and according to the side of the wheel N with which the pins co-act, the tappets are relatively brought together or separated from one another by a certain amount—every pin producing a movement of one tooth of the wheel. For example, a movement of one tooth may represent an increase of half-a-minute between the lighting up and extinguishing times. By this means there is provided an arrangement in which the daily increase or decrease in the length of daylight is compensated, and, according as this is on the increase or decrease, so the pins are caused to act on one side or the other by the cam on the year wheel, when this form is used, or by a hand adjustment of the cam U every six months when hand means are provided.

Controlling the Supply of Gas to Recording Calorimeters.

PARKINSON AND W. & B. COWAN, LIMITED, of Birmingham, and BEASLEY, F. G., of Smethwick.

No. 27,981; Dec. 23, 1908.

This invention relates to means for supplying gas to registering gas calorimeters and other instruments for standardizing, testing, and other scientific purposes, where it is essential for the supply to be absolutely constant and invariable in quantity. Reference to the arrangement was made in the "JOURNAL" for Sept. 21, p. 758.

For instance, the patentees in their specification write, to enable the calorific value of a given gas to be ascertained with exactitude by a recording calorimeter, it is essential that an invariable unit quantity (or weight) of the gas should be delivered to the instrument in given unit time, irrespective of variations in temperature and barometric pressure or other disturbing factors; and the principal object of the invention is to provide a gas-controlling or regulating appliance whereby this result may be attained.

This gas-controller, adapted to be interposed between a sensitive pressure-governor connected with the main gas supply and the calorimeter or other instrument—comprises a drum (similar to an ordinary wet gas-meter drum) enclosed in a casing and rotated by the pressure of the gas. The drum is of a capacity suitable for delivering a predetermined number of cubic feet of gas per hour when turning at a certain number of revolutions per hour, and is connected with the regulating or controlling mechanism so as to ensure that it shall pass the metered gas either in constant volume of gas per time unit under all conditions of temperature and barometric pressure, or in absolutely uniform quantity per time unit, irrespective of any slight variations in the pressure of the gas supplied through the governor, or of any changes in the density, temperature, or other physical condition of the gas, or of any slight obstruction from tar or other deposits in the pipes on the delivery side, or other causes.

The governing or controlling of the measuring and delivering drum, as regards the passing of an invariable unit (volume or quantity, as the case may be) in a given unit time, is effected by gearing the drum (which is rotated only by the pressure of the gas) to pendulum or balance-wheel and escapement mechanism. In the case of a pendulum escapement, and when it is desired to deliver constant quantity per time unit as distinct from constant volume, provision is made for automatically altering the swing of the pendulum, and, consequently, the rate of the delivery rotation of the drum, in order to compensate for variations in the density and volume gas under the variations in barometric pressure and temperature.

Further, in order to counteract any intermittency or unsteadiness such as would occur as the consequence of the alternating engagements and disengagements of the escapement pallets and escape-wheel if the drum was geared directly or rigidly on to the controlling movement, the connection between the drum-spindle and the first wheel of the escapement gear train is made through a spring, or other flexible device, tensioned by the initial movement of the drum, and supplies the motive force for driving the escapement under the control of the pendulum. It also admits of the drum continuing to rotate steadily during the instants that the gear train is momentarily arrested by the engagement of an escapement pallet with the escape-wheel, and which rotation of the drum is transmitted to the spring and utilized to keeping the spring at the proper tension for maintaining a steady impulse on the escape gear, as well as a steady controlling resistance to the rotation of the drum under the driving pressure of the gas.

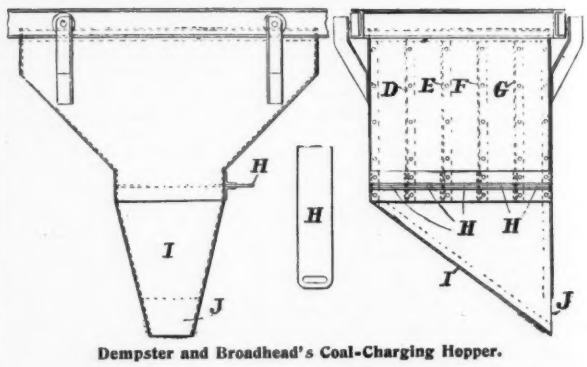
Feeding Measured Quantities of Coal.

DEMPSTER AND SONS, LIMITED, and BROADHEAD, J. W., of Elland.

No. 28,202; Dec. 28, 1908.

The principal object of this invention is to provide a receptacle or magazine for delivering at will a number of successive charges of coal to gas-retorts.

The "magazine" may be in the form of a travelling hopper, the main body of which is divided by partitions, the distance apart of which can be adjustable into a number of compartments each capable of being put into communication with a common outlet by a single slide or door or a separate door to each compartment. The outlet may be in the bottom of the hopper; one side or face being inclined, and the opposite side open. In this construction the slide works horizontally across the hopper—opening first the compartment at one end (say, the end nearest the outlet), then the second compartment, and so on. The amount of movement of the slide corresponding to the complete opening of each compartment is indicated by marks or otherwise, so as to give an external index. On the slide being actuated to open one compartment, the contents of the compartment drop on to the incline and pass out of the opening in the shoot.



Dempster and Broadhead's Coal-Charging Hopper.

Where a separate slide is fitted to each compartment, the quantity delivered can be regulated by pulling the door open (say) only half way. The contents will then run from the outlet until the angle of repose of the material is reached; leaving a portion of the contents on the partly-opened slide door.

The body of the hopper, shown provided with wheels running on rails, is divided by vertical partitions D, E, F, G into five open-topped compartments, each normally closed at the bottom by a horizontal slide H. The withdrawal of one of the slides allows the contents of the compartment to fall on to the inclined bottom I of the hopper and pass to the outlet J. In charging the hopper from a central position above, the outer compartments might receive a smaller quantity of

the material fed than the central one. In order to obviate this, the outer partitions may be inclined towards the centre—that is, they may be set on radial lines from an imaginary point above the hopper, so as to equalize the charge. This, however, is said not to be essential, as a slight movement of the travelling hopper during feeding will effect the same purpose.

Liquefaction of Illuminating Gas by Pressure.

BLAU, H., of Augsburg, Germany.

No. 2292; Jan. 30, 1909. Date claimed under International Convention, Jan. 31, 1908.

This invention relates to the liquefying, by pressure, of gases distilled from oils, shales, brown coal, and other bituminous materials; and its object is to remove from the mixture, during the liquefying process, hydrocarbons which boil between 30° and 100° C., and which, if present in the mixture after the liquefaction, do not revert to the gaseous state when the liquid is exposed to atmospheric pressure, or pressure slightly above atmospheric pressure. These hydrocarbons have heretofore been separated, prior to the liquefaction of the gaseous mixture by pressure, by cooling the mixture at normal pressure to a temperature of—10° or—20° C., whereby the hydrocarbons are liquefied, and thus separated from the more permanent gases in the mixture.

According to the present invention, however, the separation is effected without cooling the mixture below normal temperature, and in the course of the operation of liquefaction by pressure. For this purpose, the compression of the mixture (during which the gases are kept at normal temperature by cooling with water, as heretofore), is in the first instance carried to a pressure of approximately 20 or 30 atmospheres. At this pressure, the hydrocarbons referred to become liquid, and are separated from the more permanent gases. The latter, with the exception of such constituents as cannot be liquefied at normal temperature, are then liquefied by increasing the pressure to 100 atmospheres, or whatever pressure may be required. Prior to the compression, the gaseous mixture is subjected to the usual cleansing process.

The hydrocarbons liquefied at the pressure of 20 or 30 atmospheres have the property, the patentee states, of dissolving appreciable quantities of the residual gas; and at the pressure referred to, they become supersaturated with such gas. In order to recover the dissolved gas, the supersaturated liquid hydrocarbons are conducted to a chamber communicating with the suction-conduit of the compressor by which the illuminating gas is compressed. By this means, the dissolved gas is liberated and returned to the compressor.

Treatment of Tar.

COULSON, S. G., of Rotherham.

No. 7427; March 27, 1909.

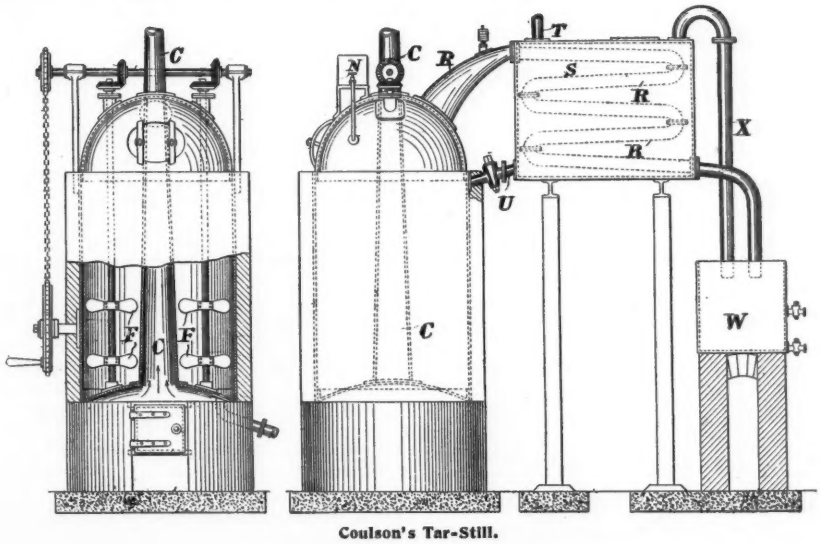
This invention has for its object to render the tar "more remunerative to the producer by providing an economical process which is carried out in apparatus of simple form." It has been previously proposed, the patentee states, to solidify tar by the addition to it or admixture with it in an open vessel of sulphuric acid; but the "comparatively large quantities (such as 3 to 7 per cent.) of acid necessary render the process so costly as to prohibit commercial success; and it has been found that the process can only be successfully performed in a closed vessel owing to the sulphurous fumes which are given off." It has also been proposed to treat tar in a single closed vessel for enriching it by the addition of large quantities of sulphuric acid—viz., not less than 10 per cent.

The present invention comprises an improvement in the sulphuric acid process which is carried out in closed distilling and treatment apparatus whereby two operations may be carried out therein—that is to say, first, the simple distillation, and, secondly, where steam is not available, an operation in which the raw tar is run into the still and heated, and the volatile matter—such as naphtha, light oils, and creosote oils (say) those passing over up to about 270° C.—taken off (in ordinary distillation steam is now necessary to assist in passing over the anthracene oils having a distilling point of from 270° to 360° C.); the remaining material being a semi-pitch, to which is added, while still in the closed still, 1 to 2 per cent. by weight of sulphuric acid—the whole being thoroughly mixed by stirring. The product may now be run off into the cooling chamber or pitch-bay, and, when cold, will be quite hard.

The volatile matter passes over at about these temperatures: Light naphtha, 0° to 110° C.; light oils, 110° to 170° C.; carbolic oils, 170° to 225° C.; creosote oils, 225° C. to 270° C.; anthracene oils, 270° to 360° C. The changing points, however, vary with different tars; and thus it is said to be necessary to make an analysis of the tar in order to ascertain at what point it would be advisable to change in order to get the best yield of each product. Even a tar obtained from the same source will vary greatly from time to time.

Suitable apparatus for carrying out the process is shown. It comprises the still proper enclosed to the desired extent by brickwork and provided at its base with a suitable furnace from which leads a central stack or uptake C passing upwards through the domed cover. Within the still is agitating or mixing mechanism, consisting of paddles or vanes F mounted on vertical shafts extending upwards through the cover, and rotatable by bevel gear, chain and sprocket gear, or other convenient manner. At the base of the still is the pitch outlet provided with a cock (not shown). The stirring mechanism is necessary when the acid described is being used, but may be dispensed with when simple distillation is being carried out. For the acid, a container N is mounted above the cover and provided with a discharge pipe having a cock, so that the acid may be admitted to the still in the quantities desired.

The vapour pipe R, zig-zag in shape, is connected with the dome of the still near to the internal stack; and the zig-zag portion passes through an auxiliary tank or vessel S containing coal tar, which serves as a condenser, into a receiver W. The vessel S is preferably of the same capacity as the still; and the tar is led to it through the pipe T.



Coulson's Tar-Still.

The vessel acts as a condenser, and simultaneously the vapour imparts its heat to the contents. When the treatment and distillation in the still are completed, the heated tar from the vessel is run into the still through the pipe U—thus "rendering the process substantially continuous, and effecting considerable economy in the cost of fuel." The water, naphtha, and other volatile constituents are driven off through the pipe X into the receiver W, which is provided with cocks at different levels for drawing off the contents of different densities.

Incandescence Mantles.

BAGRACHOW, G., of Paris.

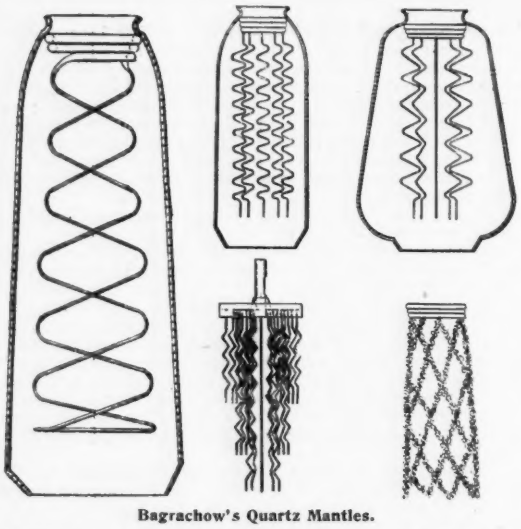
No. 5598; March 8, 1909.

This incandescence mantle consists of a framework of filaments or pieces of quartz (rock crystal or silica) with which has been incorporated rare earths.

It has hitherto been suggested, the patentee points out, to coat filaments of incandescent media with a pulverulent layer of incandescing substance by repeatedly immersing it in a solution of salts, and raising it to incandescence after each immersion. It has been found, however, that by this process the oxides "do not firmly adhere to the filaments." To obviate this, according to the present invention, the filaments are repeatedly softened by heat and then dipped, while hot, into a solution of rare earths after each softening, "whereby the latter become incorporated with the filaments"—the process being repeated until a sufficiently thick coating is deposited on the filaments.

The mantles illustrated are formed of filaments of quartz drawn out according to a variety of forms, and attached to a disc of glass or of quartz; and the disc can, in turn, be attached to the upper part of a protective chimney, or to a wide vessel of quartz or glass. The disc can also be provided with radial projections, in order to place it simply upon the upper edge of a chimney (waved or straight). The disc can, moreover, be in one piece, with a projection which permits of suspending the mantle in the usual manner from a hook fixed to the burner. In any case, it is cut out or has perforations for the free passage of the combustion gases.

When the model of the mantle is finished—that is, when the filaments of quartz in their final shape are secured to the disc—the mantle is heated in the flame of a bunsen burner for ordinary gas, or of a furnace with gas under air pressure, and is then plunged into a solution of rare earths. These rare earths are the same as those used for ordinary incandescence mantles made of thread, &c.; but in order that an incorporation may take place of the rare earths with the quartz, it



Bagrachow's Quartz Mantles.

is necessary to make use of solutions in amyllic alcohol, ether, &c. A suitable solution (preferably employed) is one made with alcohol of high strength—70° to 90° Beaume. This produces upon the quartz filaments of a rough coating more or less pronounced. The roughness is obtained gradually by plunging the filaments in the bath of rare earths and returning them to the flame of the heating burner. The oftener the filament is dipped and reheated, the rougher it becomes. These roughnesses are said to produce "a dazzling light, even when in the mild bunsen flame." By drawing out quartz softened by the heat, and dipping it in the bath of rare earths, it is said that "one can arrive also at the incorporation of the rare earths," and "filaments are thus obtained which give a fine incandescence and which can be compared to those of the electric lamps."

Mantles constructed in this way, it is claimed, possess various important advantages: "They are very little fragile, and do not run the risk of breakage at the least shock like ordinary mantles; they are capable of being mended—in fact, one can replace broken filaments by other filaments; one can also repair a damaged mantle—proceeding by a succession of heating operations whereby the filaments are alternately heated and dipped in the bath of rare earths."

APPLICATIONS FOR LETTERS PATENT.

27,589.—Wangelin, F. G., "Water supply pipes." Nov. 26.
27,611.—Badcock, E. B., "Internal-combustion pumps." Nov. 27.
27,625.—Barnett, H., "Compressing gas or air for lighting purposes." Nov. 27.
27,678.—Long, F. C., and St. Stephens, R. de H., "Temperature-indicating apparatus." Nov. 27.
27,704.—Brook, F. H., "Valves and cocks." Nov. 29.
27,720.—Auld, J., "Stop-valves." Nov. 29.
27,733.—Stephens, R. H., "Inverted burner." Nov. 29.
27,744.—Gratieux, F., "Flexible gas-tubes." Nov. 29.
27,745.—Thomas, J., "Gas lamps and burners." Nov. 29.
27,748.—Richardson, J. S., "Regulator." Nov. 29.
27,797.—Stone, J., and Co., Ltd., and Jakeman, G. E., "Cocks and valves." Nov. 29.
27,812.—Adamson, R. A., "Cleaning mains." Nov. 29.
27,828.—Pringle, R. W., and Richards, L. S., "Carbonization of coal." Nov. 29.
27,835.—Noakes, H. W., "Mantle support." Nov. 29.
27,866.—Rose, A., and Bellamy, W., "Incandescent burners." Nov. 30.
27,868.—Rose, A., and Bellamy, W., "Inverted burners." Nov. 30.
27,869.—Süssmann, H., "Incandescent burner." Nov. 30.
27,872.—Laycock, T., "Globes and holders." Nov. 30.
27,918.—Bowen, J., "Cocks and valves." Nov. 30.
27,919.—Ofenbau G. m. b. H., "Closing retorts." Nov. 30.
27,921.—Clark, F. & F. W., "Conveying coke." Nov. 30.
27,945.—Cars, B., "Globes." Nov. 30.
27,952.—Deterding, C. A. G., "Acetylene inverted burner." Nov. 30.
27,967.—Hoare, G. C., and Ackland, T., "Stopcocks and valves." Nov. 30.
27,991.—Davies, W. W., "Taps or valves." Dec. 1.
28,003.—Gibbons Bros., Ltd., and Green, G. W., "Charging gas-retorts." Dec. 1.
28,027.—Ofenbau G. m. b. H., "Closing retorts." Dec. 1.
28,041.—Chrimes, C. E., and Woolhouse, A. F., "Liquid-meters." Dec. 1.
28,054.—Moores, W. G., "Purifying gas." Dec. 1.
28,055.—Moores, W. G., "Making gas from oils." Dec. 1.
28,086.—Gibbs, C., "Gas fire-lighter." Dec. 2.
28,095.—Shaw, A., "Blowers and exhausters." Dec. 2.
28,111.—Mason, J., and Masters, R., "Lubricating gas-exhausters." Dec. 2.
28,218.—Nieser, E., and Paleschowsky, J., "Atmospheric burners." Dec. 3.
28,318.—Walker, W., "Rotary engine or blower." Dec. 4.
28,329.—M'Kenzie, J., and Richardson, H., "Vertical chambers used in connection with water and other mains and branches in roadways." Dec. 4.
28,364.—Radcliffe, J., "Purification of ammonia waste liquid." Dec. 4.
28,366.—Anderson, D., "Gas-lamps." Dec. 4.
28,370.—Martin, A., "Gas-heated radiators." Dec. 4.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Supply of Gas at High Pressure.

Sir,—The interesting paper read by Mr. S. R. Barrett, and your editorial remarks on high-pressure gas [Nov. 30], recall some notes I published in 1902 relative to this subject. I then wrote as follows:—

High-Pressure Gas.

> I am confident there is much room left for improvement in the matter of distribution of gas. The day will come when high-pressure gas will be distributed through small and sound mains, instead of large and leaky ones. Even now it is not uncommon to meet with a gas company whose "unaccounted-for gas" is from 15 to 20 per cent. of the make. If it be as little as 5 per cent., we rejoice; but I hope we shall see the day when it will be reduced to less than 1 per cent., and when a satisfactory system of occasionally testing all mains and services will be adopted.
>
> We all see that high-pressure gas-mains are being introduced in America—somewhat restricted at present, but capable of more all-round treatment. They have proved successful. Why not? What can be done with steam in this way, can be better done with gas.
>
> High-pressure gas, however, is useless unless you have sound mains and services to convey it, and proper means of regulating its delivery to the consumers. The latter difficulty could be met by consumers' governors, or perhaps better by special burners.
>
> While speaking of high-pressure gas, I have often thought that the time will come when gas will be both purified and stored at high pressure. We have got so into the habit of thinking that, to deal with gas in the process of purification, it is necessary that it should be in a highly-expanded condition, that the bare suggestion of purifying compressed gas comes as a shock to the nerves. But time will prove. Gas, like electricity, is yet in its infancy—at any rate, so far as its economic handling and delivery are concerned.

At the time the above notes were written, I do not think there was a single high-pressure gas supply in the country. Nor was there anything of the kind on the Continent. The United States alone had moved in this direction; and that to a very small extent indeed.

Five years before this—viz., in 1897—I suggested the adoption of a high-pressure main to the Bournemouth Gas Company; but it was not then adopted.

Since 1902, considerable strides have been made; but it is my firm belief that the practice of high-pressure gas supply will be extended later on, almost to the exclusion of every low-pressure supply.

All bulky old mains will be abolished, and steel mains of small diameter substituted for them. The chief thing now standing in the way of this is the mass of capital buried in underground cast-iron pipes. Unfortunately, the joints of such pipes are for the most part unfitted for resisting anything approaching high pressure.

The supply of high-pressure gas by the Birmingham Corporation, as described by Mr. Barrett, is at present only an appendage to the ordinary supply. The experience gained with this may probably lead to the more general application and use of high-pressure gas in this country, until eventually low-pressure gas may be discarded altogether.

71, *King William Street, E.C., Dec.* 6, 1909. F. S. Cripps.

LEGAL INTELLIGENCE.

THE WELSBACH COMPANY'S TRADE MARK.

Clerkenwell Police Court.—Saturday, Dec. 11.

(*Before Mr.* Bros.)

The proceedings taken against the Welsbach Incandescent Gaslight Company, Limited, by the Wolfram (Tungsten) Metal Filament Lamps, Limited, for selling and exposing for sale goods to which, as was alleged, a false trade description had been applied (see *ante*, p. 628, and preceding issues of the "Journal"), were brought to a close last Saturday by the withdrawal of the summonses.

Mr. Rufus Isaacs, K.C. (who with Mr. H. A. Colefax and Mr. Ernest Lunge appeared in support of the summonses), said he had had an opportunity of discussing the matter with Mr. Walter; and he proposed to take a course which he hoped would meet with his Worship's approval, and would be considered proper in the circumstances, having regard to the investigation which had already taken place. They had realized that it must necessarily be, and had already been, a long, protracted, and expensive inquiry, and that between firms such as he represented, and that represented by his friend, there ought to be some means of arriving at a settlement of a dispute of the present character, so that they might avoid the necessity of continuing the proceedings. He was glad to say they had been able to reach a point at which it became useless to continue the investigation there, or to ask for any judgment from his Worship. His friend would state that Dr. Auer von Welsbach was not the inventor of the electric lamps sold by the Welsbach Company, and that those advertised by them were not the lamps made by the German Auer Company. He accepted without reserve the statement that Mr. Walter had made to him to the effect that the defendant Company had no intention of misleading any persons by the advertisement they issued, and that they did not intend to lead the

readers of that advertisement to believe either that Dr. Auer von Welsbach was the inventor of the lamp, or that it was manufactured by the Auer Company. His friend had also stated that the defendant Company would not again issue the advertisement in the previous form, nor any advertisement containing words calculated to lead persons to believe that Dr. Auer von Welsbach was the inventor, or that the Auer Company were the manufacturers, of the electric lamps they were selling. Accepting these statements, it appeared to him that the proceedings might end by the withdrawal of the summonses.

Mr. A. J. WALTER, K.C. (who with Mr. BODKIN represented the defendants), said he agreed with the remarks Mr. Rufus Isaacs had made, and he desired, on behalf of the Welsbach Company, to state that they had not the smallest intention, in issuing the advertisement complained of, to lead persons to believe that the lamp was the invention of Dr. Auer von Welsbach, or that it was manufactured by the Auer Company. They certainly did not intend to repeat the advertisement. Of course, they would continue to mark their goods with the name "Welsbach," and their trade mark "AUR" would be continued on their lamps.

Mr. BROS said he thought the parties were very wise. Inquiries such as the present must naturally be very expensive. Scientific witnesses and professional men had to be brought there at great expense; and then the inquiry was merely preliminary to another which would have been perhaps even more expensive. The time had not been wasted if it had had the result of the parties coming to an agreement in open Court. He had great satisfaction in knowing that the case was now going to be withdrawn.

Mr. RUFUS ISAACS: All the summonses will be withdrawn, and also the summonses that were pending against Mr. Laurence Fletcher. I accept his statement as to his having no intention to mislead.

The summonses were accordingly withdrawn.

LIQUIDATION OF THE WEST SUBURBAN GAS COMPANY.

In the King's Bench Division of the High Court of Justice, on Monday, Nov. 29, Mr. Justice Phillimore had before him an application by the West Suburban Gaslight and Coke Company, Limited, in liquidation, for the return of the sum of £400 paid by the Liquidator (Mr. A. Edwards) to the Official Receiver as Trustee in bankruptcy of H. P. Bernard, otherwise H. W. Gyde. It will be remembered that Gyde some time ago entered into partnership with Darby as stockbrokers, though, as a matter of fact, they bought up gas properties and floated companies to purchase them, at enhanced prices. On April 27, 1905, a conveyance was executed to Darby and the bankrupt, trading as Darby and Co., which included real estate and various gas plant; and on Aug. 10, 1905, Darby and the bankrupt conveyed the property to the West Suburban Gas Company. In the following year, the Uxbridge Gas Company entered into an agreement to buy up the undertaking of the West Suburban Company; and on Oct. 15, 1906, voluntary winding-up was agreed upon. As the result of arbitration proceedings, the Uxbridge Company had to pay the West Suburban Company £1808 as the price of their undertaking. It was then discovered that the two men were undischarged bankrupts; the Senior Official Receiver being Trustee of Gyde and the Official Receiver at Cardiff being Trustee of Darby. Gyde's Trustee claimed some portion of the purchase price, on the ground that the conveyance included real estate. After considerable negotiation, the value was fixed at £400; and on the 27th of October the conveyance was executed to the Uxbridge Company, who paid the purchase-money. After the conviction of Gyde, the original articles of partnership were discovered, and, following the decision of Mr. Justice Neville in the case of the Kent County Gas Company, application was made for repayment of the £400, on the ground that it had been paid under a mistake in law. For the Official Receiver, it was argued that there was nothing to show that the property was bought out of partnership moneys, and that the circumstances of this case were entirely dissimilar to those of the Kent County Company. Mr. Hansell appeared for the applicant; and Mr. Mellor for the respondent. His Lordship said he was clearly of opinion that this was partnership property, and that the money must be refunded; but the applicant would have to pay the costs of the Official Receiver, as he was responsible for the mistake, and also the sum of £27 15s. 4d. expenses incurred by the Trustee.

Prestatyn Urban District Council and the Gas-Works.—As the result of the parliamentary proceedings in the past session by which the Prestatyn Urban District Council obtained power to purchase the gas-works belonging to Lady M'Laren, an arbitration was held at the Surveyors' Institution on Monday and Tuesday last week to determine the price to be paid. The Arbitrator for the owner was Mr. Corbet Woodall; Mr. E. H. Stevenson acting in a similar capacity for the Council, and Sir Hugh Owen being the Umpire. The purchase price was put on the one side at about £20,000, and on the other at about £6000. At the close of the proceedings, of which a report is unavoidably held over, the Umpire reserved his decision.

Death from Gas Poisoning.—A youth named Walter Stanley Lillicrap, aged 18, was on Thursday morning last found in a water-closet at his parent's house suffering from gas poisoning. A doctor was summoned and artificial respiration was tried, but without result. At the inquest on Friday, it was stated that the deceased was an apprentice in the Royal Dockyard, Devonport, and sat for an examination the three previous days. He had not done so well as he expected, and seemed depressed on Wednesday evening, but was afterwards bright in his manner. He was missing at the usual time for going to work on Thursday, and on the closet being entered he was found lying against the door partly dressed. The gas-tap was turned on; but the father, who made the discovery and turned off the gas, did not know to what extent. It was suggested that the tap might have been left on by accident, and that deceased was overcome by the fumes. The Jury found that death was due to gas poisoning, but that there was not sufficient evidence to show whether it was accidental or otherwise.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY.

Exceptional and Eventful Year in the History of a Gas Undertaking.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. J. H. BIRCHENOUGH, C.M.G., in the chair.

The SECRETARY (Mr. W. Martin) read the notice calling the meeting; and the Directors' report [*ante*, p. 552] and the statement of accounts were taken as read.

DIRECTORATE CHANGES.

The CHAIRMAN, before commencing his address, apologized for the absence of the late Chairman (Mr. Arthur Lucas), who was confined at home through an attack of influenza. Proceeding to move the adoption of the report and accounts, he first dealt with two points of domestic interest. He said that since the Directors last met the proprietors, Mr. R. Hesketh Jones had, to their regret, resigned his seat upon the Board. Mr. Jones had been a Director for nearly sixteen years; and by his wide experience, his profound interest in the affairs of the Company, his constant willingness to take even more than his share of the work, he made himself a most valued colleague. He felt, however, that the time had come when he ought to lighten his burdens; and the Board failed to convince him of the contrary. They missed, and should continue to miss, his assistance and advice. He (the Chairman) was sure he expressed the feelings of the proprietors, as well as those of the Board, when he said they hoped Mr. Jones might be spared to enjoy many years of lessened anxiety and responsibility. It had not been necessary to fill his place on the Board, because they had already an additional member, and had now returned to their original number. At the end of June, Mr. Lucas resigned the position of Chairman of the Company. He had been a Director for 22 years, and Chairman for nearly eleven years. His years of office had been laborious and eventful ones in the history of the Company. His colleagues knew, and the proprietors knew, how admirably, how devotedly, and how loyally Mr. Lucas had performed his duties. As one of his oldest friends, he might perhaps be allowed to speak with intimate personal knowledge. He knew no man who had more conscientiously fulfilled the duties of Chairman of a public company. Mr. Lucas had never hesitated to sacrifice his time, his convenience, and even his health where the interests of the Company were concerned. He (the Chairman) had only to remind the proprietors, for instance, of his visit to Italy after the great strike in the year 1901, when such a visit involved considerable personal risk, or of the worries which preceded the memorable lawsuit, and the long days of anxiety he passed in Court during the trial of the case he alluded to, to show that he in no way exaggerated. He had accompanied Mr. Lucas upon many visits of inspection to works upon the Continent, and so could speak with confidence of the high respect and regard in which he was held by the foreign staff. All his colleagues would, he knew, unite with him in paying a tribute to the unfailing courtesy and kindness of Mr. Lucas in the chair to each and all of them. They deeply regretted, and he was certain the proprietors shared the regret, that Mr. Lucas should have decided to seek a less onerous position. Though they lost his services as Chairman, he was happy to say he remained a member of the Board, and would, they trusted, continue for many years to give them the advantage of his great knowledge, his wide experience, and his loyal co-operation. His (the Chairman's) colleagues had been good enough to select him to succeed Mr. Lucas. He took the chair at a time of difficulty and some anxiety, but he had already found—as he knew he should find—that he could rely upon the kindness and loyal support of his colleagues. He felt sure he might equally rely upon the proprietors extending to him that indulgence which was never denied by any body of Englishmen to a man who honestly did his best to serve them.

MESSINA EARTHQUAKE—POSITION OF THE GAS-WORKS.

He would pass now to the more general affairs of the Company. The most important event of the year was undoubtedly the great and tragic earthquake which visited Sicily on Dec. 28 last. The details of the appalling catastrophe were no doubt still present to their minds, so he need not enlarge upon them. As soon as the Board heard the news, they asked Mr. Lacombe, the then Agent-General in Italy of the Union des Gaz, and Mr. Morton, the Chief Engineer at Genoa of the same Company, to proceed at once to Messina, in order to carry assistance to their unfortunate employees, and to ascertain the extent of the damage done to the Company's property. With great difficulty, and with considerable danger, they reached Messina, where they found the City in ruins, and a prey to horrors of every kind. The Company's general offices, shop, and manager's house were entirely destroyed; for a church—one of the largest in Messina—had fallen upon them, completely overwhelming them, and burying the Manager (Mr. Ruggeri), his wife, and daughter, under their ruins. The works (which, as the proprietors were aware, were situated upon the seashore just outside the town) were severely damaged, but by no means destroyed. It was impossible to gauge the actual damage done to the mains and public lamps, because the streets were covered with enormous piles of *débris;* but it was clear that the mains must have suffered severely, because the upheaval was most intense in the centre of the town. As speedily as Mr. Lacombe and Mr. Morton could, they ascertained the extent of the death roll, which, besides the Manager and his family, included the cashier, the storekeeper, and from 30 to 40 workmen. That more of their people had not perished, was due to the fact that the majority of them were off duty, and lived in a poor quarter of the town on high ground, outside the line of the earthquake movement. They found the survivors gathered together in the neighbourhood of the works; and, he need hardly say, terribly demoralized by the dreadful experiences they had passed through. Mr. Lacombe and Mr. Morton at once supplied them with money, and rendered them all the assistance in their power to tide over till a

permanent settlement could be arrived at. A trusty agent was left in charge of the Company's property; and he (the Chairman) was happy to say, he had faithfully performed his duty. They had to thank Mr. Lacombe and Mr. Morton for performing, with great courage and tact, an arduous task, carried out amid scenes calculated to try to the utmost both the nerves and the senses. Many of the Messina employees found their way, with such members of their families as survived, to Genoa and Milan. They were received with the greatest humanity and kindness by the representatives of the Union des Gaz; and, wherever possible, temporary work was found for them. At the suggestion of Mrs. Lucas and Miss Davenport-Hill, a subscription was opened in London—quite apart from the General City Relief Fund; and between £500 and £600 were most generously subscribed by shareholders and friends connected with the gas industry, both at home and abroad. By this means, the refugees were provided with clothing, and were assisted till they could be dealt with through the larger national funds. He took this opportunity of thanking most gratefully all those who so kindly contributed.

FROM THE MESSINA WRECK.

As soon as permission could be obtained from the authorities, their officers endeavoured to rescue from the works stocks of coal, coke, and other residuals. These had been sold. Meters and fittings were sent to Genoa, and were gradually being disposed of. In this way, they were able to secure property to the value of close upon £5000. At a later date, the Board sent a representative to Messina to deal with the claims of their employees and workmen who, under the organico, had rights to gratuities and pensions. He was happy to say that these claims had all been settled upon a basis which, he thought, was quite equitable to both parties. As they had to deal with about 160 persons, the task was necessarily a somewhat complicated one. He understood that many of these people had since emigrated to South America.

PRESENT POSITION—FUTURE AT MESSINA.

He now came to the present position of the undertaking at Messina, with regard to which the proprietors would naturally expect him to give some information. And here he had to deal with two questions—the town arrears and the future of the works. With reference to the first, he might say that, as soon as the Board reasonably could, they sent in a statement of claim to the Royal Commissioner, who, early in the year, took over, and was now exercising, the functions and powers of the Municipality. The proprietors might have seen in the Press that the Italian Government had passed special legislation with regard to the debts of municipalities affected by the earthquake, giving a legal extension of time during which their debts might be liquidated. The Company were, of course, subject to such legislation; and they would be dealt with in the same manner, and upon the same terms as other creditors—neither better nor worse. What these terms were, they did not at present know; but the Directors were taking the best legal advice as to the Company's exact rights, and would defend the interests of the stockholders with the most powerful legal assistance they could obtain in Italy. With regard to the future of the works, he could only make one or two observations. Though nearly a year had elapsed since the earthquake, it was only quite lately that progress of any kind whatever had been made with the rebuilding of the City. The Board were now informed that a beginning had been made of what was practically a new quarter of the town, to the west of the old city, and on the side furthest from the works. This, for the first time, brought the question of their future action into the range of practical politics. Before, however, they could come to a decision, it would be necessary to secure a technical report drawn up upon the spot; and this they were making immediate arrangements to obtain. The position was a complicated and delicate one; and in view of future negotiations, he should prefer to say as little as possible that day. He therefore asked the proprietors not to press for information. They might feel confident that the Directors were fully alive to the duty they owed to the proprietors to find the solution of the question which would leave them the least possible loss.

THE FINANCIAL EFFECT.

While he had no desire to minimize the misfortune which had overtaken the Company at Messina, he was anxious that its effects upon their finances should not be exaggerated. He thought perhaps it had been exaggerated in some quarters. What was the exact position? The undertaking at Messina—including the town debt—represented less than 10 per cent. of the Company's capital. Even supposing it had been wiped clean out (which was certainly not the case), they had against it a reserve of £40,000, a carry-forward of over £12,000, after writing off the sum of £22,000, as mentioned in the report, and further, they had a great reserve, which was not set out in the accounts. He referred to the fact that the Union des Gaz shares were taken at cost; whereas they were quoted in the market at a premium of over 60 per cent. He therefore thought he might claim that there was no need for pessimism. On the other hand, the Board felt that, whatever success might attend their efforts in the proceedings and negotiations he had referred to, there would be a considerable loss; and they believed they would best consult the interests of the proprietors by facing the position frankly and squarely, and that they would have their support in doing so. They had consequently decided to write off at once a first and very considerable instalment from the Messina outlay. As was stated in the report, they had taken £10,000 from the reserve fund (which, at the date of the last balance-sheet, stood at £50,000), and £12,000 from the total of profits available for distribution. By this means they reduced the amount standing to the debit of the Messina outlay from £82,000 to £60,000 odd. In order to effect this result, and to carry forward a slightly larger sum of undivided profits than last year—viz., £12,954, as against £11,126 last year—they were asking the proprietors to reduce the dividend from 6½ to 5 per cent. for the year. The Board ventured to think that this policy of looking a loss in the face, and making provision for it, would strengthen the position of the Company, and would meet with approval. ["Hear, hear."]

THE ANNUAL ACCOUNTS.

Looking at the accounts which accompanied the report, and turning to the general revenue account, it would be seen that the management and general charges amounted to £2711, which was £81 more than in 1908. The actual charges were really less than last year; but, of course, nothing had been debited to Messina as in previous years. He should like to say at this point that both last year and this year the Directors had taken £1000 less in remuneration than they were authorized to take by the Articles of Association. On the other side of the account, the dividends on the Union des Gaz shares held by the Company amounted to £65,937, which showed an increase of £1813—due to the fact that the dividend upon the 4000 new shares was now paid in full. There was rather less for interest this year than last. The balance carried to the net revenue account was £67,098, as against £71,102 last year. Turning to the net revenue account, it would be seen that they had to add to the above figure the amount of £11,126—the balance forward from last year. These together made a total of £78,225. He had already explained that they were taking from this total £12,000 in reduction of the Messina outlay account, so that they were left with £66,225 available for distribution. If the final dividend of 2½ per cent. for the half year was approved, they would, as already mentioned, carry forward £12,954, as against £11,126 last year. Under the circumstances, he thought the proprietors might be fairly satisfied with the position.

AFFAIRS OF THE UNION DES GAZ—NEW WORKS.

And now he would pass to the affairs of the Union des Gaz, in which Company they were so deeply interested. In the way of general information, he had not much to add to the statements in the report. In spite of increasing charges for debenture interest and debenture redemption (which were the necessary concomitants of a constantly developing business), the Union des Gaz had been able to maintain their dividend at 9 per cent., and to carry forward £13,358 to the new account. This was a very satisfactory result of the year's working. There was one point he wished to say a few words about, and that was capital expenditure. It would be noticed that a large sum had been spent at Milan, Genoa, and Strasburg, in all of which towns the business of the Union des Gaz continued to grow. At Milan and Genoa the Company were, as was known to the proprietors, constructing two most important new works; and he wished to point out that any future extensions of these works would be carried out at a much smaller rate of expenditure than was represented by the present initial outlay. When works were designed for a certain number of units, the first unit cost far more than subsequent units, because, at the outset, they had to buy the land, to lay down the connections in the works, to put in the large mains uniting the works with the town, to build gasholders in excess of immediate requirements, offices, &c.; but for subsequent units, a large portion of these charges was saved. Let them take a single example. The Bovisa works at Milan had cost £212,000 for the first unit, which had an output of 21,000,000 cubic metres. The second unit, which was in course of construction, would only cost £60,000 for an output of 27,000,000 cubic metres. He need not labour the point further. It would be seen that they were now entering upon a period of greatly reduced capital expenditure.

THE GREAT STRIKE OF GAS WORKERS IN ITALY.

ECONOMY SHARING REFUSED—REASONS FOR THE STRIKE.

As succinctly as possible, he would now deal with the great strike which was in progress at all the Italian works of the Union des Gaz during almost the whole of the month of November. Labour troubles in Italy had occupied a large place in the Chairman's speech for many years past. Mr. Lucas had from year to year kept the proprietors acquainted with the long struggle which had gone on uninterruptedly—sometimes more or less under the surface, sometimes breaking out into actual strikes, and cessation of work. Just two years ago, after a strike which had resulted in the Company yielding to the men's demand for an increase of 10 per cent. all round, on the understanding that certain important questions of discipline (closely connected with the men's refusal to do a fair day's work) should be referred to arbitration, Mr. Lucas gave a distinct warning that the Company had reached the limit of their concessions, and that further demands would be resisted to the utmost. Since that date, the Company had continued to do everything in their power to ameliorate the conditions of work, and to meet every legitimate grievance, without waiting for the award of the arbitrators to which he had just referred, the issue of which had for various reasons been delayed. Those of the proprietors who were present at the meeting last year would remember that a suggestion was made by Mr. Hunter with regard to the possibility of adopting some scheme of profit-sharing with the men; and Mr. Lucas undertook that the suggestion should be brought before the Board of the Union des Gaz, and should be carefully considered. Well, upon the lines of that idea a scheme was put forward by the Union des Gaz in the month of July last, offering the men of the Italian stations the half of any economies which might be effected in the labour bill of the year by a re-arrangement of the work upon a more rational, a more economical, and a more efficient system. When he reminded them that in Italy 2½ tons of coal per man were carbonized, against 6 to 8 tons in England, France, and Germany, it would be seen that this scheme offered large opportunities of economy-sharing, both to the men and to the Company. The offer was not accepted. He was not sure it was seriously considered, because the more violent of the men's leaders were working up for another strike, and were anxious to bring it on at once for two reasons—first, because, although the arbitrators in connection with the settlement of 1907 had not given their award, it was known that the experts' report was favourable to the Company; and, secondly, because the Italian Government contemplated passing a law in January next for the prevention of strikes, and for making arbitration compulsory in connection with all public services.

THE MEN'S DEMANDS.

With these two possibilities in view, the leaders of the Federation thought it advisable to make a supreme effort to obtain as much as possible from the Company before the arbitrators gave their award, and before the proposed law was put into force. He ought in fairness to say that a large number of the men were opposed to the policy of the extremists; but it was the extreme policy which prevailed. On Oct. 19

the men's demands—embodied in a *memoriale*—were sent in; and the Company were given thirteen days to reply. The principal points were:

1.—An all-round increase of 10 per cent. in wages.
2.—A considerable number of special increases of pay, in addition to the above, and sundry shortenings of the hours of labour.
3.—The abandonment of the arbitration referred to above.
4.—The abolition of piecework.
5.—The suppression of all contract work.
6.—The establishment of an agency in the works for the taking on of all workmen and employees under the control of the men themselves.
7.—All stokers and assistants to be granted 24 days' holiday a year on full pay, in addition to the weekly day's rest lately granted by law.

If these demands had been granted in full, they would have cost the Union des Gaz something like £50,000 per annum. They were refused *en bloc*; and reasons for their refusal were given to the men, and were communicated to the authorities.

FOREWARNED AND FOREARMED.

He might say at once that the strike was not unexpected. Partial strikes or cessations of work had been continually occurring throughout the year for the most trivial reasons. There had been twenty in eight months. As soon as the Union des Gaz saw that a struggle was inevitable, every preparation was made to meet it, in order that the Company might fulfil, without any break, its contractual obligations to the municipal bodies, and to the inhabitants of the four cities they lighted in Italy. A careful plan of campaign was laid out. The services of trained mechanics were retained in England to take charge of all the machinery, stokers were recruited in Germany, and yard labour in Italy. Assistant engineers and stokers were held in readiness to proceed to Italy from Strasburg and the French works of the Company. The strike was declared on the evening of Tuesday, Nov. 2. The same evening the various works of the Company were occupied by troops, and were cleared of strikers who left in an orderly manner. The Englishmen were the first to arrive, and for twenty-four hours they aided the engineers and the few faithful men in keeping the furnaces going. At Bovisa, they made gas from the very first. On Wednesday night, special trains brought the "free workers" into the works at Milan without incident—to the great surprise of the strikers; and a similar result was attained at Genoa, with equal promptness—thus vindicating the skill and completeness with which the plans had been laid by the two chief officers of the Company. Twenty-four hours were spent in completing the organization of the new *personnel*, and in cleaning the furnaces and ovens, which had been left in a bad state by the strikers.

COURSE OF THE STRIKE.

From Thursday night, Nov. 4, the manufacture of gas proceeded smoothly; and by the end of the week it was practically normal both at Milan and Genoa. At first, the public lighting could not be maintained, as it was impossible to get the lamps lit; but after a few days the lamps were lighted in the middle of the night, and were kept burning night and day during the rest of the strike. He need hardly say that many acts of damage to public lamps were committed, and mains were in some instances torn up and ignited. These were dealt with by the authorities. He would not weary the proprietors with details, nor would he trouble them with the special difficulties incidental to each separate town—Milan, Genoa, Alessandria, and Modena. He would only say that in each town the Managers received adequate military protection, and that they gradually and surely overcame the great difficulties that confronted them. As soon as the Board were satisfied that the gas supply could be maintained, the Managers were instructed to issue a manifesto, with the approval of the authorities, stating that all the men were discharged, that the Company resumed their liberty of action, and were ready to re-admit applicants upon their signing the new conditions of engagement which had been drawn up. He wished to state very clearly that these conditions did not include any reduction whatever of wages, or any diminution whatever of privileges and advantages—such as pensions, sick pay, &c. Their object was solely to restore to the Company such control of their works as was absolutely essential for efficient and economical working. Under the old organico, the Company were absolutely powerless to organize their works on the basis of either efficiency or economy. They had to endeavour to fulfill their contractual obligations under conditions which had become intolerable, and indeed impossible. The principle they fought for was the right to adapt their organization to the economic requirements of the industry. The manifesto was posted up at Genoa on Nov. 9; and at Milan, Alessandria, and Modena, two days later. Its publication was speedily followed by the opening of negotiations on the part of the men, who offered to withdraw their *memoriale*, and to return to work upon the old conditions. The Company, however, regarding the acceptance of the new regulations as vital to any settlement, held firm. He might say at this point that letters were received from several of their large shareholders encouraging the Board of the Union des Gaz to maintain this attitude.

COLLAPSE OF THE STRIKE.

It was unnecessary to give the details of the protracted negotiations which were carried on during the next ten or twelve days. At Milan discussions proceeded almost continuously between representatives of the men, the Prefect, the Syndic, and the Company's Manager (Mr. Grüss). On Nov. 21, an agreement was arrived at, but was refused by the men on the 23rd. At the instance of the authorities, some concessions of detail were made by the Manager, the most important of which was the institution of a permanent Board of Reference—consisting of two representatives of the Company, two of the men, with an independent umpire—to which certain disciplinary questions would in future be referred. This agreement was accepted by the men's representatives—subject to a ballot of the men themselves. The ballot took place on the 25th, when 600 voted against acceptance, 300 for, and about 800 did not vote. The Company's Manager then posted up a notice to the effect that all the men who had not signed their acceptance of the agreed conditions by four p.m. on the 26th would be definitely replaced by other applicants. More than 1000 men signed the agreement in the course of the day; and on the 27th, the strike was at an end, and work was resumed by the whole body of workmen. He had dealt mainly with the history of the strike at Milan, because it was at Milan that labour troubles had always been most acute, and the difficulties of the Company most aggravated. Much that he had described applied equally to Genoa, and in a lesser degree to Alessandria and Modena. At Genoa, Mr. Morton had made the same complete and skilful preparations as Mr. Grüss had made at Milan; and he maintained throughout the same inalterably firm attitude. He had this advantage over Milan, that the whole body of his clerks remained faithful to the Company, and rendered him valuable assistance. All through the strike, and in the final negotiations which led to a settlement, he acted in complete independence of—although in close consultation with—Milan; and it was to this policy of individual action that the success of the Company might in part be attributed. The acceptance by the men at Genoa of the new regulations was as complete as at Milan; and in one or two respects, the settlement at Genoa was more favourable to the Company. In the negotiations both at Milan and Genoa, the Company had the advice and assistance of Mr. Rolando Ricci—one of the most distinguished lawyers in North Italy.

FREEDOM THE RESULT.

The proprietors might fairly ask him what the Union des Gaz had gained by this costly struggle. His reply was that they had freed themselves from the old organico, which for years had bound them hand and foot, and was surely strangling them. There never was any desire on the part of the Company either to reduce wages, or to cancel the privileges which had been gradually granted to the men. All that the Company fought for was liberty to manage their works with a maximum of efficiency. The old organico was now replaced by a new regolamento, which gave the Company the right to take on, and to promote, the men they thought most suitable for each class of work; to reduce the number of their employees, with due notice, if, in the opinion of the Managers, reductions were justified by such causes as changes in machinery or processes of manufacture, or changes in the system of accounts; and generally to regulate the staff according to the exigencies of the business. These seemed very elementary rights for an employer to possess; but they had been denied to the Company for some years. It was well worth all the expense and anxiety of the past month to have regained them. He was confident now that the struggle was over, the Company would treat all its *personnel* with consideration, would continue steadily to improve the conditions of labour in every department, as they had done in past, and would welcome a gradual increase of individual wages if it were accompanied by a genuine and unmistakable increase of efficiency on the part of the men. He ventured to hope that a brighter day had dawned for the Union des Gaz in Italy, and for all those whom they employed.

A DESERVED TRIBUTE OF PRAISE.

Before he sat down, he must say a few words about the Company's representatives and staff in Italy, upon whom the burden and heat of the fight had fallen. The Union des Gaz had been most fortunate in having men so courageous, so unflinching, so loyal, and so devoted, to represent them in their hour of difficulty. Of Mr. Grüss, he could not speak too highly. He made all his preparations with consummate skill, and with an unfailing grasp of details. He (the Chairman) had already pointed out the promptitude with which an extemporized *personnel* was got into the Milan works, and began the manufacture of gas. That spoke for itself. Then for nearly a month Mr. Grüss was subjected to pressure from the authorities, the Press, and the public, and to threats and abuse from the more violent of the strikers. He was never intimidated; he never flinched for one moment; he never lost sight of the essential points upon which concession was impossible, until he finally brought about the satisfactory arrangement that he (the Chairman) had described. It was a great performance; and the thanks of the Company were due to Mr. Grüss for it. He was ably seconded by Mr. Di Bisogno, Mr. Hovey (the Chief of the Technical Staff), Mr. Freyss (the Chief Engineer of the French stations), Mr. Blow, Mr. Cuffia, Mr. Bocchi, the Sub-Engineers, and the able gentlemen sent from Strasburg and the French works. He could not mention all by name; but one and all deserved well of the Company for their hard and devoted work. In Mr. Morton, at Genoa, the Union des Gaz were equally fortunate. He possessed those qualities which, they were proud to think, belonged to many Englishmen—coolness, patience, courage, and staunchness. He (the Chairman) could only say that his performance at Genoa was a worthy pendant to the performance of Mr. Grüss at Milan. Much that he had said of Mr. Grüss was applicable, in equal measure, to Mr. Morton; and to him the thanks of the Company were equally due. Mr. Morton was admirably assisted by Mr. Cucchi, Mr. Cesari, Mr. Bickley, and, indeed, by all the staff at Genoa. The Company had also to thank warmly Mr. Pesce, their Manager at Alessandria, and Mr. Maggioni, their Manager at Modena. They were also deeply indebted to the heads of those industrial establishments and gas companies in this country, through whose assistance they were able to secure and send to Italy skilled mechanics to take charge of the machinery throughout the strike; and he took this opportunity of thanking them on behalf of the Union des Gaz. His tale of thanks would not be complete if he did not bear grateful witness to the protection afforded to the Company by the military and police authorities in Italy. Absolutely impartial, they secured to the Company full liberty of work, and enabled them, with the least possible interruption, to maintain the public service. He feared he had detained the proprietors too long at a busy hour of the day; but the events of the year had been so full of interest and importance that he felt he owed them the most ample information. He concluded by formally moving that the report and accounts be received and adopted.

The DEPUTY-CHAIRMAN (Mr. Frederick Tendron) seconded the motion.

ACKNOWLEDGMENTS FROM THE PROPRIETORS.

Mr. H. E. JONES said the recital of the Company's misfortunes of the last few years, and the courage and fortitude with which the Board had met them, demanded the sympathy of the proprietors, and next their admiration. Above all things, he thought the Board had dealt very wisely with the questions associated with the terrible loss at Messina. He admired the courage and sound finance with which the Directors had appropriated so much of the reserve and profits for this

purpose. The courage, too, with which they had met the labour strike in Italy also deserved the gratitude not only of the proprietors, but of all people interested in the industry of gas. It was only when they could find such men as (the late) Sir George Livesey, Mr. Grüss, Mr. Morton, and others, that they could show people they must not be unreasonable. However, it seemed they had now passed through the trouble at the works. He heartily congratulated the Board on the state of the accounts, and the courage they had shown under extraordinary pressure.

Mr. WALTER HUNTER said he was sure the proprietors greatly appreciated the work and the courage that the Board and the heads of departments in Italy had shown under the very difficult circumstances that had arisen during the past year. It only proved once more that if one would only be just, one need not fear. Firmness of mind was the only way of dealing with men as in dealing with boys. As the Chairman said, he (Mr. Hunter) advocated the application of co-partnership at the last meeting; and, notwithstanding the Chairman's remarks, he still hoped that some day or other it might take effect. It seemed to him they ought again to follow the example of Sir George Livesey. Sir George first beat his men in fight; and then he gave them co-partnership. That was a course he would recommend under present circumstances to the careful consideration of the Board. The proprietors thanked the Chairman for his admirable and lucid speech; and they greatly appreciated the services of the Board and the heads of departments in the terrible struggle of the year.

The CHAIRMAN thanked Mr. Jones for his exceedingly kind remarks; and he should like to say to Mr. Hunter that the Board would not lose sight of the principle of profit-sharing. They agreed with him that, after a victory such as they had won, it was much easier to adopt a system of the kind than it was before.

The motion was unanimously carried.

THE DIVIDENDS.

Proposed by the CHAIRMAN, and seconded by Mr. N. E. B. GAREY, a resolution was passed declaring a dividend of 5 per cent. on the ordinary stock and 7 per cent. on the preference stock, after deducting the interim dividend of 2½ per cent. on the former and 3½ per cent. on the latter—the balance of 2½ per cent. on the ordinary stock being paid free of tax, and the 3½ per cent. on the preference stock less tax.

RE-ELECTION OF DIRECTORS AND AUDITORS.

The DEPUTY-CHAIRMAN moved the re-election of Mr. Birchenough to his seat at the Board. After the able discourse to which they had listened that morning, he was sure the proprietors would accept the motion without hesitation. The Chairman had referred to Mr. Lucas, and had pointed out that he never spared himself, but did all that was humanly possible for the good of the Company. Among the good things he did was to introduce Mr. Birchenough to the Board.

Mr. A. F. PHILLIPS seconded the motion, which was carried.

Proposed by the CHAIRMAN, and seconded by Mr. PHILLIPS, Mr. R. S. Gardiner was also re-elected.

Both the CHAIRMAN and Mr. GARDINER acknowledged the renewed expression of the confidence of the proprietors.

Moved by Mr. WALTER HUNTER, and seconded by Mr. CAVE ORME, the Auditors (Mr. A. T. Eastman and Mr. C. P. Crookenden, F.C.A.) were reappointed.

VOTES OF THANKS.

Mr. PHILLIPS said he had much pleasure in moving that the thanks of the meeting be given to the Secretaries, Managers, and the Engineers of the Company and of the Union des Gaz, both in London and abroad, for the special services rendered by them in the past year. The proprietors would have gleaned from the Chairman's address the arduous character of the year through which their officers had passed, especially those in Italy. He was himself in Italy immediately before the strike; and he could bear testimony to the excellent preparations that had been made by Mr. Grüss in Milan and by Mr. Morton in Genoa. The proprietors could form no idea of the enormous strain these two gentlemen had had to bear during the month of the strike. He must also particularly mention their excellent Secretary, Mr. Martin. The time that he had during the strike was difficult to realize. He was in the office from morning till evening, seven days a week, continually receiving long telegrams, and consulting with the Chairman as to the replies. Practically for three weeks or a month Mr. Martin had no rest. He (Mr. Phillips) was only surprised he was able to bear the great strain and carry on the negotiations so satisfactorily. Without him, the Company's position would have been somewhat difficult.

Mr. R. S. GARDINER seconded the motion, remarking that its passing ought not to be a purely perfunctory matter on this occasion. All on the proprietors' and the Directors' sides of the table realized how greatly their thanks were due, and how hardly they had been earned.

The CHAIRMAN remarked that he had himself been in contact with the office every day for at least a month; and he could add his testimony to that of Mr. Phillips as to the admirable way in which the work had been done in the London office, as well as in Italy.

The motion was carried by acclamation.

Mr. MARTIN said, on behalf of himself and all concerned in the motion, he thanked Mr. Phillips, Mr. Gardiner, and the Chairman for their kind remarks, and the proprietors for their approval. But notwithstanding all the complimentary things said about himself and his colleagues abroad and in London, the general management, without loyal and hearty co-operation, would not be so efficient.

Mr. E. WOOLLEY observed that there had already been remarks from the proprietors' side of the table as to the services of the Chairman and Directors; but it was desired to emphasize and enforce these remarks by passing a vote of thanks. He happened to be himself interested in an industry carried on in Italy on a small scale; and so he could fully realize what the Directors had suffered.

Mr. E. A. GOULDING, in seconding, remarked that the Board had had great difficulties in front of them, and the proprietors had again and again had this difficulty of a labour strike hanging over them. But he felt that the difficulty was now behind them, and that its back had been broken. It was mainly due to the way the Board had grasped the question, and settled it, that they were in the very satisfactory position existing that day.

The motion was heartily carried.

The CHAIRMAN, in responding, said one thing that encouraged the Board in times of difficulty such as the months through which they had been passing, was the consciousness that they had behind them a most generous body of proprietors, who recognized that the Board were doing their best, and so supported them.

This concluded the proceedings, which, through the peculiar circumstances of the year, had been somewhat more protracted than usual.

BISHOP'S STORTFORD COUNCIL AND THE GAS-WORKS.

Application to Parliament for Power to Purchase.

At the Meeting of the Bishop's Stortford Urban District Council last Tuesday, there were two motions on the *agenda* with regard to a proposal to purchase the undertaking of the Bishop's Stortford and District Gas Company. The first was—"That in the opinion of this Council the time has arrived when, in the interests of the ratepayers, it is desirable that the gas-works should be acquired by the Council for their benefit;" the second—"That a poll of the town be taken to ascertain whether the inhabitants are in favour of the purchase or not."

The VICE-CHAIRMAN (Mr. H. Kent) said before moving the first resolution, which stood in his name, he would suggest that the two resolutions might be consolidated.

The CHAIRMAN (Mr. J. L. Glasscock) said he had consulted the Clerk with regard to the second resolution, and was afraid that it was out of order, as the Council had no power to vote money for taking a poll of the parish.

The VICE-CHAIRMAN said, as the first motion must stand alone, he would move it as it appeared upon the *agenda*. He looked upon the action the Council were taking as practically the last struggle it was possible for them to enter into with regard to the gas question. If they did not do something that night, they would be placed in such a position that he thought they could say "Good-bye" for ever to the possibility of the municipalization of the gas-works of the town. The last time the Council divided on the question, it did so in such a manner that there were six on one side and seven on the other. If the town had then taken the advice given to it, it would to-day have had one of the finest assets that any municipality could have in its possession. At that time the capital of the Gas Company stood at £10,000 or £12,000. He knew that the market price then was somewhere in the neighbourhood of £22 10s. per £10 share. The Council missed the opportunity because there were certain members—good members of the Council, good citizens, good townsmen—who were afraid of arbitration; and they lost one of the most golden opportunities that could ever present itself to a local authority. They then came down to another stage, when he strongly argued in favour of purchase. This was the time when the previous Bill was put forward by the Gas Company, and the Company was changed into what was now known as the Bishop's Stortford and District Gas Company. At that period the Council, by a fairly good majority, went to the extent of getting inserted into the Bill a purchase clause which should be operative for a period of twelve months. It carried with it conditions; but if the town had availed themselves of them it would have been a good thing. At that time the Council called in an expert on gas. He knew that some looked upon that gentleman as one of the strongest men in the gas world. He was one of the strongest men in the gas world against municipalization; and therefore when the inquiry was held he (Mr. Kent) was not surprised that some of the members thought it would be doing a serious wrong and would be burdening the ratepayers for many years if it purchased the gas-works. But when they reviewed with an unprejudiced mind the municipalization of various gas undertakings throughout the country, and looked at the figures which were produced, they were forced to come to the conclusion that municipalization had been a success from the very beginning. Naturally, there had been some failures; but they must not gauge the mistakes unless they also put on the other side the advantages which had come to the community in the many places where the municipalization of the works had been a success. Having cited cases in support of these statements, the speaker came back to Bishop's Stortford. He said the Gas Company, according to their last balance-sheet, made about 46 million cubic feet of gas per annum, that they were paying dividend on a capital of £34,620, and that the borrowed capital was something like £11,400—making a total of £46,000. But there was a certain amount of capital in the £46,000 which had nothing to do with Bishop's Stortford. He could not tell what was now the consumption in the outer area. He knew that, prior to taking over the Stansted works, Bishop's Stortford burnt something like 30 million cubic feet of gas per annum. If with the extended consumption they were now supplying 38 millions, it would show that about 5 or 6 millions went to Stansted. They knew what the condition of things was. It appeared that the inner circle was paying the piper to-day to keep the people of Stansted in good trim and fettle to defend the Gas Company. When they came to consider the outer area, which was scheduled with a maximum price of 5s., and also the inner circle scheduled with a maximum of 4s., they found that the outer circle had been given a benefit of 1s. 3d. and Bishop's Stortford only a benefit of 3d. from the maximum; and it was time, if this thing did go through, that they should declare that the outer circle should not be given a benefit to the detriment of the inner. He felt satisfied he had done his duty in bringing the motion forward; and he sincerely hoped there might be sufficient members of the Council who saw the urgent necessity of utilizing what he might call the last opportunity of purchasing the undertaking of the Gas Company.

Mr. NEWEY said he had not the slightest hesitation in seconding the motion. The Gas Company was one of the best paying concerns they had in Bishop's Stortford; and if the Council made up their minds to buy, and the present most efficient management could be retained, no injustice would be done to anyone, and the proprietors would get a very good price for their shares.

Mr. WATERMAN, as one who many years ago advocated the purchase of the gas-works, when they could have been bought at a much smaller

cost than now, supported the motion. He agreed with Mr. Kent that the gas-works in the hands of the Council would be one of the finest assets the town could have.

Mr. EDWARDS remarked that while it might have been advisable for the town to purchase the gas-works when they were valued at £10,000 or £12,000, he could not see that it would be advisable to do so now. A year or two ago the Council succeeded in obtaining an Electric Lighting Order, which they held at the present time. They had thought fit to get expert advice on it, and found that electric light could be installed for about £13,000. They could use electricity for power, light, and heat; and he took it that this was all the town needed. He considered it would be a great deal wiser if the Council went in for electric lighting straight away. If they spent £100,000 in the purchase of the gas-works, it seemed to him that it would hamper the town, and be a charge on the ratepayers for many years to come.

Mr. CARRUTHERS remarked that the most deadly opponent of the Electric Lighting Order would be the Gas Company. There was no doubt that if the town purchased the gas-works at a reasonable price they could be made to pay. He did not think anyone had the right to mention £100,000 as the price, as this was a question which would come on in due course. What the Council had now to do was to get to know whether or not the town was in favour of the proposal. Therefore he did not see his way clear to merge his motion with that of Mr. Kent. If the Council decided to proceed with the purchase of the gas-works, he would propose that a vote of the town be taken.

The CHAIRMAN (interposing) pointed out that Mr. Carruthers' motion was out of order.

Mr. CARRUTHERS said the position was different to-day from what it was on the last occasion that this question was discussed. The Gas Company were about to form a big combine, which would be something in the nature of a trust. The Company was a very powerful one; but the proposed combine would be all-powerful. In his judgment, Bishop's Stortford was being exploited as a bait to the villages around to come into the combine. He felt that the position was altogether different from what it had been in the past; and he hoped there would be public spirit enough in the Council to say they would have what belonged to them—the right to provide their own gas. He had pleasure in supporting the motion.

Mr. HOLLAND said he was as strongly as Mr. Kent, or anybody in the Council, in favour of municipalizing the gas-works; but he was a trader, and liked to know what he was going to purchase before he put his signature to anything. In this case, he did not know what the Council would have to pay; and if a vote was pressed that evening, he should vote against it. They would have to pay a very big price for the property; and whether the Council ought to saddle the town with the risk of making the gas-works pay was a very serious matter.

The CHAIRMAN remarked that they would all be agreeable to the acquisition of the gas-works on condition that they were purchased on reasonable terms; but no one who had spoken had been able to give any information on this point. He thought it would be wise before the Council decided to purchase the works at a cost of £100,000 or a little less, that they should bear in mind they had other things in view, and that these might come on at any time. Four years ago he recorded his vote against the purchase of the gas-works for the reason that the amount the town would probably have to pay would be excessive. If this was so then, what would be his position to-day? The sale price must be considerably larger, and therefore he could not, without further information and more definite figures, feel justified, as a representative of the ratepayers, in giving his vote for the proposal.

After some further discussion,

The VICE-CHAIRMAN replied. He said that £12,000 or £13,000 was mentioned as the purchase price of the gas-works at one time. But never since he had been on the Council had there been any idea that they could be purchased for anything like £13,000. He asked the members not to be led away with the idea that there would be a huge increase in the rates by the municipalization of the gas-works. The probability was that the rates would go down. From every standpoint they looked at the matter, he was convinced that it must be for the benefit of the town to purchase the Gas Company's undertaking.

Mr. PRYER said that, as very few members could vote on the motion that night, he hoped Mr. Kent would postpone it for a time and allow the subject to be ventilated in the town.

This, however, was not done; and on the motion being put, it was carried by five votes to four. Three members of the Council who were unable to vote and one who had left the meeting (Mr. Holland) were against the motion.

It was then decided that the necessary work arising out of the resolution should be undertaken, and that the Council should promote a Bill to acquire the Gas Company's undertaking; Messrs. Baker and Co., Parliamentary Agents, being appointed for the purpose.

The Council's Parliamentary Notice.

In accordance with the resolution passed by the District Council, the statutory notice for the Bill, dated Dec. 8, appeared in the local paper later in the week. It sets forth that application will be made by the Council for authority to purchase, by compulsion or agreement, the undertaking of the Bishop's Stortford District Gas Company, and take over all their rights and powers. Provision will be made for the settlement by arbitration, in default of agreement, of the amount of the purchase-money or compensation to be paid to the Company. The Council wish to be authorized to carry on the undertaking, improve the existing works, construct new ones, and supply gas within the urban district of Bishop's Stortford and the limits of supply of the Company, or such reduced limits as may be prescribed. The Bill will contain the usual provisions in regard to matters incidental to a gas undertaking—such as the price, pressure, quality, and testing of gas; the regulation of pipes and fittings, &c.; the purchase and sale of land; the sale or letting on hire of meters, fittings, engines, stoves, &c.; the levying of rates and charges; and the supply of gas in bulk. Authority will be asked to borrow the necessary money for purchasing and carrying on the undertaking, on the security of the revenues of the Council and the district fund and general district rate. It is also proposed to ask Parliament to amend the Bishop's Stortford Electric Lighting Order, 1905.

UNIVERSITY OF LEEDS.

Lectures on Gas Manufacture and Bye-Product Coking Processes.

We have received from Professor W. A. Bone, D.Sc., F.R.S., the Head of the Department of Fuel and Gas Engineering at the University of Leeds, a circular announcing that, in connection with the work of the Department, arrangements have been made for the delivery of special courses of lectures on "The Manufacture of Coal Gas" and "Bye-Product Coking Processes," which will be open to all persons engaged in either of the industries concerned.

MANUFACTURE OF COAL GAS.

A course of twenty lectures will be given by Dr. Harold G. Colman on Wednesdays, at 6 p.m., and Thursdays, at 9 a.m., during the second term (ten consecutive weeks), commencing on Wednesday, Jan. 12, 1910, and continuing until Thursday, March 17. The fee for the course will be £1 1s.

Synopsis.—A general description of the plant and processes involved in the manufacture of coal gas and carburetted water gas. Description and valuation of coals suitable for gas making. Analysis of coal. The chemical and physical changes involved in the carbonization of coal. Effects of temperature and other factors on the nature of the products. Horizontal, inclined, and vertical retorts. Construction of retort-settings. Methods of maintaining uniform temperatures throughout the retorts, with simultaneous economy in fuel consumption. The initial treatment of volatile products evolved from the retorts. Hydraulic and dry mains. Condensation. Elimination of tar fog and naphthalene. Exhausters. Wet and dry purification. Cyanide recovery. Other bye-products—*e.g.*, coke, tar, ammoniacal liquor, &c. Manufacture of ammonium sulphate. Spent oxide, spent lime, &c. Manufacture and carburetting of water gas. The analytical control of gas-manufacturing processes. Discussion of present-day requirements for a public gas supply.

It is pointed out in the circular that the arrangements for the course will enable students living at a distance from Leeds to attend two lectures by staying one night per week in Leeds. Overnight accommodation for a limited number of students can be provided at Lyddon Hall, the Hall of Residence of the University, at an inclusive charge of 6s. for dinner, bed, and breakfast. Early application for this accommodation should be made to the Warden, Lyddon Hall, Leeds. Students are, however, at liberty to make other arrangements, and the University authorities will supply a list of registered lodgings.

BYE-PRODUCT COKING PROCESSES.

A course of eight lectures on this subject will be given by Mr. Ernest Bury, M.Sc., of the Brackley Coke-Works, Little Hulton, near Bolton (Lancs.), on Saturday afternoons, at three o'clock, commencing Saturday, Jan. 15, 1910. The fee for the course will be £1 1s.

Synopsis.—Historical introduction. Development of bye-product coking processes considered from a general standpoint. Various types of ovens and their construction. Gas condensing and scrubbing plant. Ammonia recovery and the manufacture of ammonium sulphate. Treatment of waste gases from the sulphate plant. Recovery and refining of benzol. Utilization of coke-oven gas. Selection of coking coals. Preparation of coal for carbonization. Slack washing. Disintegrators. The scientific control and management of a bye-product coking plant. The utilization of coke-oven gas for illuminating purposes. The future of the process in relation to the national economy of coal supplies.

Each lecture will be followed by a class for discussion and demonstrations on the scientific control of a bye-product coking plant.

Intending students are requested to send in their names without delay to the Registrar of the University, specifying the course or courses which they desire to attend. The fees for the respective courses are payable in advance on the date of the first lecture. Other inquiries regarding the courses should be addressed to Professor William A. Bone, D.Sc., F.R.S., the Head of the Department of Fuel and Gas Engineering, on or before next Tuesday (the 21st inst.).

BRITISH COALITE COMPANY.

Advance Details of the Report and Accounts.

In their issue of yesterday, the "Daily Mail" wrote: Awaited by many with keen interest, the report of the British Coalite Company for the year to Sept. 30 is on the point of publication. We are able to give some of its main features, which, for the present, may be allowed to speak for themselves without comment from us.

The report will state that as the year has been occupied almost entirely in development and constructional work, no profit has been realized. As a matter of fact, the sales of coalite and bye-products amounted during the year to £11,376. The biggest item of revenue earned during the year was interest payable by the parent Coalite Company on calls in arrear—£12,398 in interest, of which about half had been paid at Sept. 30. The expenditure of the year has exceeded the revenue by £21,895; the main items of expenditure being about £16,000 for coal, £13,000 for wages and salaries at the works, and £10,000 for Directors' fees, salaries, and legal expenses.

The report, it will be found, will mention the extensive plant and works being erected at Barking, Wednesfield, Plymouth, and Hythe. Somewhat apologetically, it will state that the delay in completion has been unavoidable, as the economical expenditure of a large capital cannot be hurried. But the Directors will express their "fullest confidence in the immediate financial success of the undertaking." The plants at the works of the Plymouth and Hythe Gas Companies are, it is stated, giving steady returns—the gas being rich in illuminating power; and further contracts are being negotiated with other gas companies. The

Company has received a diploma and a medal for smoke abatement exhibits. Finally, the demand for coalite, the report will state, increases daily.

Against the million sterling of capital, the balance-sheet will show that about half the sum is represented by inventions and patents; that £335,000 has been spent on land and works and the like; that the expenses in connection with the formation of the Company account for £85,809; and that the cash at the bank and in hand amounts to £7485. Of the £750,000 of £1 shares actually issued for cash, £29,104 have been forfeited; and the calls in arrear on other shares amount to £233,551. That will be shown in the balance-sheet; but the report will explain that since the accounts were made up a further sum of £62,500 has been received from the parent Company (Coalite, Limited) in reduction of the liability on unpaid calls, and that the balance will be liquidated early in the ensuing year. The Auditors point out that an item of £153,380 for which the Company take credit as expenditure at the works is subject to adjustment owing to dismantling and reconstruction, and that no provision has been made for depreciation.

THE LATE MR. G. HAMPTON BARBER.

Resolution of the Birmingham City Council.

At the Meeting of the Birmingham City Council last Tuesday, the Lord Mayor (Mr. W. H. Bowater) moved: "That this Council desire to record their sincere appreciation of the valuable services rendered by the late Mr. George Hampton Barber as Secretary and Manager of the Corporation Gas Department, to express their deep regret at his decease, and to convey to Mrs. Hampton Barber and family their respectful sympathy." In Mr. Barber, he said, the city had lost one of its most efficient and devoted officials. His business qualities and his organizing capacity were recognized as soon as he came to Birmingham; and nine years ago he was unanimously selected out of 120 applicants for the position vacated by Mr. Edwin Smith. The confidence of the Gas Committee and the Council was abundantly justified by the success with which he administered the department with increased efficiency and enlarged profits. It was particularly unfortunate that the Gas Committee should have lost the services of such an administrator at a time when further developments were in hand; and it was especially sad that he should have been so suddenly removed from a domestic circle which had already been saddened by the serious illness of Mrs. Barber. In his private as well as his public capacity the removal of his strong and optimistic personality was an almost irreparable loss. Their sympathy was especially due to the invalid widow and large family he had left behind.

In seconding the resolution, Alderman Sir Hallewell Rogers said he did not think they could realize the loss which the Gas Department had sustained by Mr. Barber's premature death. During the whole time of his secretaryship, he gave himself unsparingly and devotedly to the business of the department. Mr. Barber was one of the ablest business men he had ever met; and he had no hesitation in saying that the increased profit from the Gas Department had been largely due to Mr. Barber himself.

This resolution was carried.

IMPROVEMENTS AT THE BURTON GAS-WORKS.

Reconstruction of Retort-Houses.

At the Meeting of the Burton-upon-Trent Corporation last Wednesday, an important scheme for the extension of the gas-works was sanctioned.

Alderman LOWE, the Chairman of the Gas Committee, submitted a proposition that Mr. J. Ferguson Bell, the Council's Consulting Gas Engineer, should be instructed to prepare drawings and obtain tenders for carrying out the first section of the scheme for reconstructing the old retort-houses, the estimated cost of which will be about £16,000, and that the Gas Committee should be empowered to accept a tender for the work. He said he had gone very fully into the scheme when it was brought before the Council some months ago. He then stated that a new gasholder was needed, with the re-setting of the retorts in the most recent of the retort-houses (No. 5), and that they should build the first half of a new house, with modern improvements, in place of Nos. 1 to 4. The work at No. 5 house had been completed at a cost of about £2000, the gasholder they hoped would be completed in another month or so, and they wanted to proceed at once with the retort-house. The half which they were proposing to build would have 20 settings of retorts capable of carbonizing 120 tons of coal per day. The original estimate for the whole retort-house was £25,000; and they were proposing to build rather more than half, at an outside cost of £16,000. The Committee asked permission to accept tenders, as they would have to pull down three houses (Nos. 2, 3, and 4), leaving the other two, which were capable of producing 1½ million cubic feet of gas per 24 hours. On the previous day, they sent out upwards of 1½ million cubic feet; so it would be seen that if they did not get the work done before the beginning of next winter, they would be in an intolerable position. They would not be ready to bring the tenders before the Council at the January meeting; and if they waited till February, the contracts would have to be signed, and it would be March before they could start. They would save six weeks, which would be a material amount of time when next winter was coming on. At present every ton of coal had to be handled a number of times, which cost something like 2s. 6d. a ton; but with the new retort-house they expected to get the work done for half the cost, in addition to which they would obtain a greater yield of gas per ton, with better and more profitable residuals. The advantages were altogether out of proportion to the original cost; and when they had this house, they would be in a position to manufacture gas considerably cheaper than they could at present, and the consumers and ratepayers would receive the benefit.

Mr. KING seconded the motion.

Mr. WARDLE said the question might occur to many why vertical retorts were not being put up. The reason was because they in Burton wanted gas of higher candle power than could be obtained with that system. The class of retort they proposed to adopt would be cheaper and better, for the general purposes of a town like Burton, than the vertical retort.

Alderman LOWE supported this statement.

The motion was then put and carried.

DECAY OF PRIVATE BILL LEGISLATION.

In the course of a lengthy article under this heading in the "Pall Mall Gazette," a Parliamentary Agent made last week the subjoined remarks.

The notices for Private Bills to be promoted next session have now all been published in the "Gazette." The number of Bills of which notice has been given is 118. There may be a couple of Scotch "Substituted Bills," but the total cannot exceed 120. This is said to be the lowest on record; it is certainly the smallest number for many years. When the notices for next session, and the Bills passed during the last few sessions, come to be analyzed, it will be found that the decline has been most marked in Bills authorizing new railways, tramways, and other public works, involving large capital expenditure.

There are thirty-four Bills promoted by municipal authorities. Many of these are "Police and Sanitary" Bills—that is to say, Bills conferring on local authorities powers of regulation in excess of those given by the general law. Some aim at acquiring existing company undertakings. There are a few which seek new powers for the construction of water-works. This is a sort of expenditure which will not brook delay. But very few municipalities are proposing to carry out any works which they can possibly postpone. The small number of municipal tramway schemes is especially significant. The big corporations have acquired and electrified the tramways in their principal streets. They know that the operation of the municipal veto in Parliament makes them safe against company intrusion; and they sit down comfortably to wait for better times before they begin to so extend their systems as to give an adequate general service such as is given in most towns out of England. Meanwhile, the unemployed are occupied, with the aid of contributions from Imperial funds, in making artificial lakes. The principal cause of the cessation of municipal enterprise is, of course, the dearness of money. Unrest makes even Socialism stand still. Though small sums can readily be borrowed on good terms in the North of England from local investors, large loans are difficult to raise without depressing quotations for existing issues; and many local authorities have had to pay nearly 4 per cent.

The slump in municipal work might have its compensations if there were any corresponding increase in private enterprise. But this is unfortunately in even worse case. The only bright spot is gas. There are twenty Bills promoted by gas companies of which gas supply is the sole or principal object. Parliamentary regulation of the gas industry has been specially successful. The sliding-scale has rewarded cheap service by larger dividends. The auction clauses have almost entirely prevented company-mongering, and have, indeed, brought into existence a new class of investors who buy and sell their shares at the Auction Mart, and are more or less indifferent to Stock Exchange quotations. The best gas companies can now raise new capital on as favourable terms as railway companies. The auction clauses have created a little haven in the sea of unrest. There are fourteen company Water Bills; but many of them relate to very small places, and it is hard to avoid the suspicion that in some cases the chief object of proceeding by Bill rather than by Provisional Order has been to secure the incorporation of a parliamentary company. Parliamentary companies are not subject to the strict requirements of the Companies Consolidation Act in relation to the disclosure of contracts in the prospectus. This a matter which, in the case of new companies, might well be met by the insertion of a clause in the Act of Incorporation. There are only two Bills for electrical supply, other than electrical supply by gas companies. There is no doubt that, except for the counties of Northumberland and Durham, England is very much behind other countries in electrical supply. It cannot be supposed, therefore, that there are not a multitude of opportunities for the profitable investment of capital. Some part of the blame may be attributed to the Act of 1882. More, perhaps, may be put down to the mistakes of those who inaugurated some of the power schemes. But there is no question that at present sound electrical enterprises cannot obtain fresh capital on anything like such terms as are usual in the case of public companies operating in other civilized countries.

Protecting Dams from Lightning.

In proposing the adoption by the Birmingham City Council of the Water Committee's report, Alderman Beale remarked that they had had before them a very interesting little engineering proposition with regard to the protection of the Welsh dams from the effects of lightning—a subject which had given them great anxiety. Sir Oliver Lodge had been consulted, and had confirmed them in the view that a good solution of the difficulty would be to connect the lightning conductors with the water, which was a valuable disperser of the electric fluid. It was necessary, however, always to "earth" the conductor, if he might so speak, on the surface of the water. This gave some difficulty, owing to the continual rise and fall of the level. Sir Oliver Lodge suggested a buoy moored away from the dam, to which the conductor could be connected. This idea had been carried out with modifications by Mr. Macaulay. The buoy was so arranged that the points of discharge should always be on the surface of the water, even when rocking from a high wind. They hoped they would have no opportunity of testing whether they had done right or not; but it had been an interesting work.

The price of gas at Swansea is to be reduced 2d. per 1000 cubic feet in the New Year.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Fog has again been experienced this week, in the midland district of Scotland, not so protracted as the visitation three weeks ago, but in some parts very dense. The statement was made in the "Glasgow Herald" on Tuesday regarding the experience of Monday, that the citizens generally required to resort to the use of artificial light for business and domestic purposes, and that there was consequently a renewal of the pressure experienced by the Gas Department on the previous occasion. Mr. Wilson and his staff were, however, well prepared for such an emergency. Though no figures could be given, it was estimated that the demand for gas on the previous day would be somewhat similar to that of Tuesday, Nov. 16, which was the darkest day experienced during the recent foggy weather. The amount of gas then consumed was over 37 million cubic feet. The manufacture at that date was at the rate of 27 million cubic feet per day, and consequently all the reserve stock had to be brought into requisition to cope with the extraordinary demand. Since then, however, additional retorts had been set going at the gas-works, with the result that the daily manufacture had been increased to 31 million cubic feet. This was considered sufficient to meet all the requirements of the city; and it was confidently anticipated that, should the foggy conditions not last longer than a week, there would not be the slightest possibility of a shortage in the gas supply. On the same day, there appeared in the "Scotsman," with reference to the experience in Edinburgh, the statement that at the gas-works at Granton the output during the daylight hours—say, between nine o'clock and half-past three—was increased 100 per cent. This necessitated the consumption of 100 tons more than the normal quantity of coal. On Wednesday, the statement was made in the "Glasgow Herald" that during the 24 hours which ended at six o'clock the previous morning, the consumption of gas reached the enormous total of 37,890,000 cubic feet, exceeding that of Nov. 16, when 37,200,000 cubic feet were supplied. Additional retorts had been put on, and a daily output of 33 millions could now be attained.

The Town Council of Glasgow held a special meeting on Monday to consider the Gas Consolidation Order; but not much of consequence transpired on the occasion, except that some of the councillors who hold pronounced views were afforded an opportunity of giving them an airing. The recommendations of the Parliamentary Bills Committee, as given in these "Notes" last week, were first agreed to, and then the clauses of the draft Order were considered. Bailie Alston moved that the words "dynamos and ranges" be re-inserted in the clause giving the Corporation power to manufacture. He did not think they should give away anything they could retain. The Corporation had never interfered with private enterprise, except where private enterprise failed. He was not suggesting that private enterprise would fail to supply sufficient dynamos and ranges; but he thought the Corporation should have power to supply these in case of failure. Mr. Moir proposed that the word "manufacture" should be deleted. The Corporation, he said, had over and over again voted against the establishment of a municipal workshop, and yet in that clause they took power to set up all kinds of municipal workshops. He did not think this was any part of the Corporation's business. The Town Clerk ruled that it would be incompetent at this stage, and without notice, to take away any existing power. The clause, as contained in the draft, was adopted. Mr. P. E. Stewart asked if, under the clause giving a rebate to consumers of not more than 5 per cent. for prompt payment, the rebate would be given to all consumers. Mr. M. W. Montgomery said the clause was to give them power, if they thought fit, to allow a rebate. Mr. Stewart considered that 5 per cent. was a high price. Consumers waiting for three months would lose 5 per cent., or 20 per cent. per annum; while the Corporation, on the other hand, if everybody paid cash, would probably lose from £35,000 to £40,000 a year. Lord Provost M'Innes Shaw said the clause was inserted in every Gas Bill, but usually 10 per cent. was given as the maximum, instead of 5 per cent. as they proposed. Mr. Montgomery did not think there was much chance of the power being put into operation in a hurry; but they would have the power, and it was possible at some time they would find it very useful. The clause was adopted. Clause 27 proposes that appliances for testing the illuminating power of the gas be provided in each of the works. Mr. P. G. Stewart said he understood that at present the gas was tested by Mr. Tatlock, the City Analyst, at the works. There was a prevailing idea that the gas they got in Glasgow was not up to the standard. Mr. Tatlock went to the works at various times well known to the officials, and preparations were made accordingly. Would it not be better to follow the example of London and other English centres, where the gas was not tested at the source of manufacture, but after it had travelled a mile or two along the pipes. Mr. Montgomery assured the Council that no official preparations were made for the visit of the Analyst to the works. If Mr. Stewart cared to test the gas a mile or two along the pipes, he would find the same illuminating power as at its source. Mr. Stewart reiterated his statement that preparations were made when it was known there was going to be a test. He could get twenty witnesses to prove it. He moved that the clause be taken back and amended, so that the tests might be made away from the works. The proposal was defeated, and the clause adopted. Mr. D. M. Stevenson thought that the proposed uniform rate of 2½ per cent. as a contribution to the sinking fund was the creating of a rather risky precedent if they considered that it would render them liable to make that contribution upon future undertakings, and in view of the heavy writing down required for their plant. He thought the Parliamentary Bills Committee should be given power to modify the clause, if they thought it necessary. The Convener of the Committee said they had that power; and the clause was adopted. Mr. J. Battersby, upon the clause dealing with superannuation, said it guaranteed a gratuity or allowance to every employee of the Corporation, and he thought it would be very much better if power were taken to have friendly societies formed. Mr. D. M. Stevenson pointed out that eight or ten years ago the Corporation took power to do what Mr. Battersby suggested; and though the

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scheme then proposed was rejected, the authority remained. The Town Clerk said that was so. This and other clauses were agreed to; and the Order as drafted was adopted.

Speaking in the Dumfries Town Council last week, Judge Thomson, the Convener of the Gas Committee, said that for years the Manager had reported on the state of the retort-house; and it was now considered necessary that they should have a new retort-house and coal-store. The cost was estimated at £5600. A deputation had visited several places to see if they could get any hints as to the improved methods which were now in use elsewhere. They found, for instance, that hand stoking could never do what machine stoking was doing. At Stirling, the capital of the works amounted to £82,000, and the production was 130 million cubic feet, as compared with an original capital of £58,700 and a production of 113 million cubic feet at Dumfries. It had also to be borne in mind that the consumption of gas in Dumfries was going up rapidly. Their capital debt had been reduced to £28,889; and he regarded this as a most satisfactory feature of their works. Thus situated, if they were to spend from £10,000 to £15,000, they would place the gas-works in a position which would enable them to do well, and also to supply cheap gas. In Stirling, with the aid of stoking machinery they were able to effect a saving of £2000 a year; and putting it pretty low in Dumfries, they ought to bring about a saving of £1100 by putting in machinery. The gas supply in Stirling was in the hands of a Company, who were paying a dividend of 10 per cent. per annum; and the price of gas was 2s. 6d., as compared with 2s. 10d. in Dumfries. In Kilmarnock, they had spent £60,000 in putting in new machinery; and at Falkirk, where the production of gas was 207 million cubic feet, the price was 3s. 2d. The Council agreed that the Gas Managers should submit a report and plans of a new retort-house, bench, and coal-store, with stoking machinery, and the probable cost.

The changed position which electric lighting now occupies relatively to gas lighting was illustrated by two incidents which took place in this district this week. In the Cupar Town Council, it is reported, a discussion took place in connection with the electric lighting of the streets. It was stated that the lighting was very unsatisfactory, and that it might be better to go back to gas. The matter was sent back to the Lighting Committee to make investigation. In the Cowdenbeath Town Council there was submitted an offer by the Gas Company to light the streets by gas. Bailie Shand moved that the High Street be lighted by high-pressure gas-lamps, keeping the electric lamps for the side streets. The Council agreed to have a copy of the Gas Company's offer furnished to each councillor, and that the subject of street lighting should be discussed at a future meeting.

A conference between the Carnoustie Town Council and the Directors of the Carnoustie Gaslight Company, regarding the proposed gas transfer, took place on Thursday. On behalf of the Town Council, Provost Walker intimated that they were prepared to increase their offer for the Company's whole undertaking from £19,580 to £21,000; and he expressed the earnest hope that the shareholders of the Company would favourably entertain this latest offer. Ex-Provost Ramsay, the Chairman of the Directors, stated that the offer would receive their careful consideration. The conference was a most harmonious and friendly one, and it is stated that a hopeful feeling prevails that the negotiations will end in a transfer being effected.

A somewhat violent explosion of gas took place last night at No. 31, Blythswood Drive, Glasgow. The house is at present closed, and is in charge of a servant who does not live in it, but who has been in the habit of looking in every day to see if all was right. She was in the act of lighting the gas at a gasalier in the front bedroom when the explosion occurred. By the force of it the woman was thrown down and was badly burned. The interior of the house suffered much damage. Every window was blown out, as were also some in the house above; and the ceiling of the bedroom below was blown down, as well as a window blown out. A slight fire broke out; but the Fire Brigade had no difficulty in extinguishing it.

Although Mr. Mackinnon obtained no support in the Kirkcaldy Town Council in his opposition to the gas transfer there, the opponents of the proposal are not inactive, but have taken to the holding of public meetings in the promotion of their opposition. One of these was held last Monday evening. Mr. John Blyth, J.P., who presided, said he hoped that the interest taken in the gas question through the efforts of Councillor Mackinnon would increase, so that after everybody had considered the matter they would be able, if possible, to prevent the taking over of the gas-works by the Corporation. In the course of an elaborate argument, in which statistics were used freely, the Chairman endeavoured to show that the rate of increase in the consumption of gas in Kirkcaldy had been checked during the past six years, and that the check had been experienced simultaneously with the introduction of electric lighting. In the six years from 1897 to 1902, he said, the increased consumption of gas amounted to 37 million cubic feet, which was equal to 40 per cent.; whereas in the six years since then the increase had been only 7 million cubic feet, or 5 per cent. There was a long discussion, in which Mr. Mackinnon and Mr. Wright, both members of the Town Council, spoke. No resolution was proposed.

Price of Coke at Devonport.—Considerable discussion took place at a meeting of the Devonport Town Council last Thursday on a resolution of the Gas Committee instructing the Gas Engineer (Mr. W. P. Tervet) to supply coke to *bonâ-fide* Devonport hawkers at 1s. per ton less than the current price. Mr. Daymond contended that the arrangement was unbusinesslike, and that the staff at the gas-works were placed in an awkward position through having to sell coke at prices ranging from 10s. to 16s. per ton. Mr. Harvey thought the present arrangements for selling coke must be intended as a joke. Much of the cheap coke probably went to Plymouth. Alderman Tozer, the Chairman of the Gas Committee, said the sale to hawkers at 1s. less than the current price was to be tried for a month only. That which went to Plymouth was paid for at the rate of 16s. per ton; so that if, as had been suggested, hundreds of tons of coke were going to Plymouth, it was a good thing for the gas undertaking. The Committee looked at the matter entirely from a business standpoint.

MARGINAL NOTES.

No Flame Contact.

Uniform Heat Distribution.

Condensation and Deposit Impossible.

The Acme of Simplicity.

The Mental Belt

of Radiator buyers was let out a hole or two in favour of the "Steamless" early in the 1908 season. Prejudice was soon dislodged, and the *tolerant* attitude has now given place to an "*All Steamless*" frame of mind.

The responsible factor in the case is merit—just MERIT.

A glance at the notes in the margin will serve as a reminder of what we mean.

The Davis Gas Stove Company Ltd.,
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Our New Pamphlet, entitled "The Science of Gas-Heated Radiators," would interest YOU.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 10.

Sulphate of Ammonia.

Demand has been well sustained all through the week, and a further advance in prices has taken place. Dealers having apparently covered the bulk of their requirements for December delivery, the tone hardly seems quite so strong at the close. The values now are £11 5s. to £11 6s. 3d. per ton f.o.b. Hull, £11 6s. 3d. to £11 7s. 6d. per ton f.o.b. Liverpool, and £11 7s. 6d. to £11 8s. 9d. per ton f.o.b. Leith. For January-June next year, £11 10s. per ton f.o.b. Leith is reported as having been paid in several instances, and makers have now raised their quotations for this period to £11 12s. 6d. per ton. So far, however, this action on their part has only resulted in checking further business for the delivery named.

Nitrate of Soda.

This article continues quietly steady at 9s. 3d. per cwt. for ordinary, and 9s. 6d. for 96 per cent. quality on spot; but orders are by no means plentiful.

LONDON, *Dec.* 13.

Tar Products.

The markets for tar products have been steady throughout the past week. Pitch has been decidedly better in tone, as makers report having been offered an advanced price for January-June delivery, which in most cases they have declined. Business has been done on the east coast at 26s. 6d. On the west coast, pitch is decidedly scarce, and very good figures are reported to have been offered for small lots for near delivery. Continental buyers still appear disposed to withhold their purchasing, believing that the present rise is only temporary; but it is hoped that, in view of the fact that there appears to be a fair quantity to be bought and not very much to be sold, their hopes will be disappointed. Creosote is quiet; and it is improbable that there will be any great improvement in this article for the next few months. Benzol is very firm indeed for prompt delivery, and 6d. has been freely paid in the North for 90 per cent. for both prompt and forward delivery; while in London there is very little obtainable. Good prices are reported to have been paid for 50 to 90 per cent. benzol, which is also very steady. Toluol is firm, although buyers appear to have retired from the market for the present. Solvent naphtha is steady, and there is a good demand for it for the first few months of next year. Carbolic acid is very weak; and crystals appear to be almost unsaleable. Refined naphthalene is quiet; but salts are in good demand.

The average values during the week were: Tar, 13s. to 17s., *ex* works. Pitch, London, 26s. 3d. to 26s. 9d.; east coast, 26s. to 26s. 6d.; west coast, 25s. 6d. to 26s. 6d. f.a.s. Mersey ports, 26s. 6d. f.o.b. others. Benzol, 90 per cent., casks included, London, 6⅞d.; North, 6d.; 50-90 per cent., casks included, London, 7⅜d.; North, 7d. Toluol, casks included, London, 9½d. to 9⅝d.; North, 9d. Crude naphtha, in bulk, London, 4d. to 4⅛d.; North, 3⅞d. to 4d.; solvent naphtha, casks included, London, 1s. 0⅛d. to 1s. 1⅛d.; North, 11½d. to 1s.; heavy naphtha, casks included, London, 10⅜d. to 11⅝d.; North, 10d. to 10½d. Creosote, in bulk, London, 2½d. to 2⅝d.; North, 2⅛d. to 2¼d. Heavy oils, in bulk, 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 10⅜d.; west coast, 10⅞d. Refined naphthalene, £4 10s. to £8 10s.; salts, 40s., packages included and f.o.b. Anthracene, "A" quality, 1⅛d. to 1⅜d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been firm during the past week, and prices have actually advanced to the extent of 2s. 6d. per ton. The principal Gas Companies report that they have declined £11 10s. for January-June, and ask £11 12s. 6d.; while the ordinary makes could not be secured upon Beckton terms for prompt delivery under £11 2s. 6d. to £11 3s. 9d. In Hull, business is reported to have been done at £11 2s. 6d. to £11 5s.; and in Liverpool, at £11 5s. to £11 6s. 3d. In Leith, manufacturers report having declined £11 7s. 6d. for prompt, and £11 10s. for January-June, and are asking £11 12s. 6d. for the latter period.

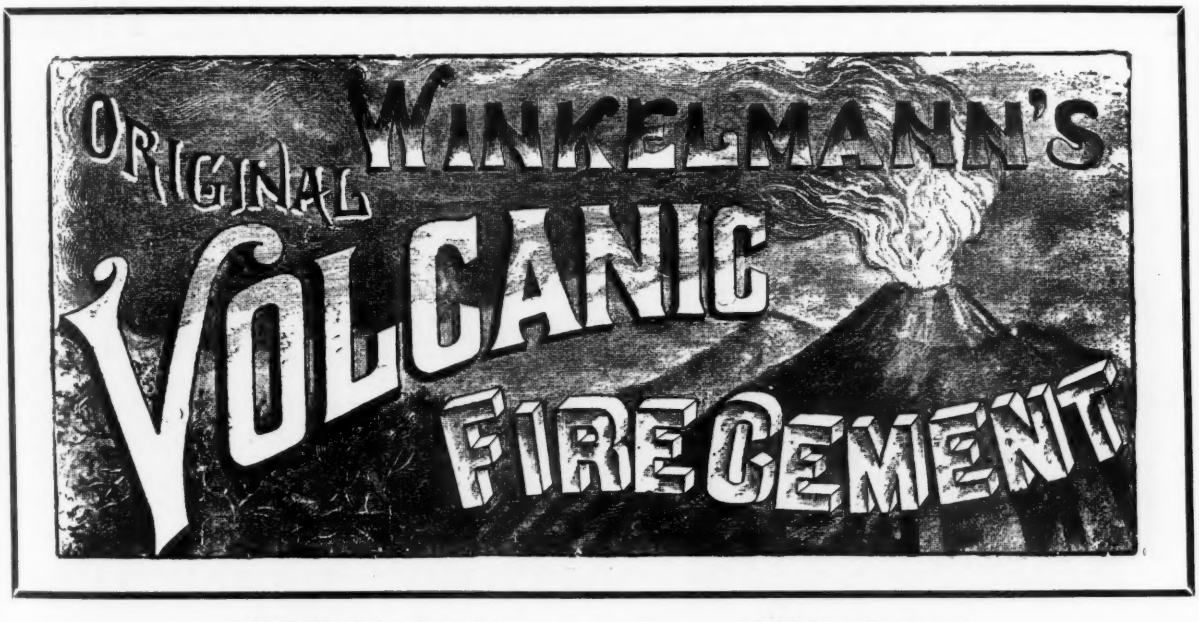
COAL TRADE REPORTS.

Northern Coal Trade.

With the better demand for coals that is often found in December, there is also a desire on the part of some users lest there should be difficulty as to working under the Eight Hours Act, which operates in the Northern coalfield after the end of the month. In the steam coal trade, the inquiry is strong; and the price of best Northumbrians is from 11s. 4½d. to 11s. 6d. per ton f.o.b. Second-class steams are 9s. 3d. to 9s. 9d. per ton; and steam smalls vary from 5s. 3d. to 6s. 3d., the latter being a little more abundant. In the gas coal trade, the demand is now at its fullest, and the deliveries on the long contracts are very heavy; so that the output is well taken up. Durham gas coals vary in price from 9s. 6d. to 11s. 1½d. per ton f.o.b., according to quality, for the usual classes, and up to 11s. 6d. for "Wear" specials. In contracts, that for Malmo has been settled for specials, at a price said to be equal to 11s. 6d. per ton f.o.b. A cargo has also been contracted for for Australia, but the prices are not stated. The contract for Stockholm gas-works (120,000 tons), for delivery over next year, has been decided. The price is believed to be equal to about 10s. 6d. per ton f.o.b., which is probably 1s. 6d. per ton more than the average price on the contracts that are now expiring. Gas coke follows the firmness of other kinds, though it is plentiful, and is quoted from 13s. to 13s. 6d. per ton f.o.b.

Scotch Coal Trade.

On account of severe weather, there has been a greatly increased demand for coal for home consumption, with a consequent advance in prices to the extent of from 6d. to 1s. per ton. Foggy weather, how-



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LEST YE FORGET.

ever, again interfered with transit. The prices now quoted are: Ell 10s. to 11s. per ton f.o.b. Glasgow, splint 10s. 9d. to 11s., and steam 9s. 3d. to 9s. 6d. The shipments for the week amounted to 277,417 tons —a decrease of 46,176 tons upon the preceding week, and of 12,310 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,321,252 tons—an increase of 647,725 tons upon the corresponding period.

Hastings Gas-Works Flooded.

Last Saturday week and the following day were particularly unpleasant in Hastings—thunder and lightning, torrential rains, and hailstorms, great cold, with intermittent gales of wind, being the prevailing weather conditions. The excessively heavy rain nearly had the effect on the Sunday night of interfering with the town's gas supply. An unprecedented rush of water broke through a dam at the gas-works at Glyne Gap, and flooded the retort-house and coal-store to a depth of a foot. If it had been but a little higher, it might have put out the fires, with calamitous results to the illumination of the streets. The works lie in the bed of a watershed, and to control the flow of water, a large quantity of which is used for the purposes of the works, the Company had erected three dams, and installed a couple of ejectors, capable of pumping 300 gallons a minute. Soon after one o'clock, the extraordinarily large volume of water flowing down broke through one of the dams, overwhelmed the pumps, and then had things all its own way. The men in the retort-house gallantly remained at their posts, though they had to wade about in water over their knees, and were placed under further difficulties by the interference of the inundation with the process of collecting the coal and removing the coke. But there was no interruption of the lighting service; though hampered as the workmen were by the presence of the water in the retort-house and in the coal-stores, the manufacture of the gas was carried on with considerable difficulty. Mr. C. F. Botley, the Engineer-in-Charge at the works, was called up early in the morning, and he at once secured the assistance of the Fire Brigade in coping with the water; and a steamer and a pumping-engine were brought into use. Even with these means, it was not until eleven on Monday night that the water was finally pumped away; and work was carried on all last week under the disadvantages and inconveniences caused by the unexpected inrush of water.

Automatic Public Lighting in Battersea.—The Lighting Committee of the Battersea Borough Council have accepted an offer from the Gaslight and Coke Company to fit the remaining public gas-lamps in their district with the Rostin apparatus, so that the lamps may be lighted and extinguished from the Company's works. At the expiration of four years, a reduction in the charges of 2s. per lamp per annum is to be made for each lamp fitted with the apparatus. The Committee report that 160 lamps in Nine Elms district have for some time been worked by the system, and have proved satisfactory.

Proposed Reduction in Price at Winsford.

The Winsford (Cheshire) Urban District Council had before them last Wednesday a motion by Mr. T. Ivison to reduce the price of gas for lighting and cooking to 3s. per 1000 cubic feet by ordinary meter, and to 3s. 1d. to consumers using slot-meters, with a charge of 2s. 6d. per 1000 cubic feet for power. In submitting his motion, Mr. Ivison said he was a great believer in the consumer having gas at actual cost price. He did not think they ought to make a profit on the works, because after something like 22 or 23 years the ratepayers would have handed over to them property worth probably from £60,000 to £70,000. When the works were acquired by the Council in 1901, the price of gas was 4s. 2d.; and he argued that the reductions which had been made on this figure always resulted in a considerable increase in consumption. Five years ago, when the price was brought down from 3s. 6d. to 3s. 3d., the consumption was 10 million cubic feet; and he estimated that next year they would sell at least 26 millions—it might be considerably more, as their sales had increased during the past four-and-a-half years at the rate of 2 million cubic feet per annum. Last year they made a profit of £1900; and his suggestion was that they should take from this sum £325, representing a reduction of 3d. per 1000 cubic feet on an estimated sale of 26 millions next year. This would leave them £1688, out of which they would be able to repay the loan, and still have £320 for new works and extensions. The chief argument of the opponents of the proposal was that the present was not the right time to make a reduction in price; the suggestion being that the matter be again considered at the end of March, when the Council would have figures showing how the new works were meeting the expected requirements. In the result, the motion was rejected by six votes to four.

Necessity for Deputations.—Speaking at the annual dinner of the local Association of Engineers, the Lord Mayor of Leeds (Mr. W. Penrose Green) referred to the magnitude of the Corporation trading concerns. No private enterprise in the city, he said, could compare with them; and the annual capital expenditure which they involved would give some idea to practical minds of the vast extent of the undertakings. He confessed that at one time he had no great opinion of the men who managed these concerns—not by any means the opinion he ought to have had. Since he had come into closer contact with the work of the Corporation, however, he realized that the men who were managing them were among the smartest men in the city; and when the ratepayers considered how much time these men spent weekly for their benefit, they should at least extend to them their thanks. But of thanks they got little. He often thought that the comparatively small allowances that were made to city councillors when they undertook deputation work were made far too much of, when the size and importance of these trading concerns were considered. Deputations were very necessary if members of the Corporation were to keep abreast of the latest improvements and most up-to-date methods.

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Repair of Pavements Damaged by Leakage.

An important question with regard to the repair of pavement injured by leakage from water-pipes was brought before the Westminster City Council at their meeting last Thursday. The Works Committee reported that the wood pavement in Wellington Street, south of York Street, was found to have subsided on the 10th ult., and on investigation the ground beneath the pavement was discovered to be soft and saturated with water; water also lying on the surface of the subsoil to a depth of about 2½ inches. On the 12th, the City Engineer (Mr. J. W. Bradley, M.Inst.C.E.) served notice on the Metropolitan Water Board, in accordance with section 112 of the Metropolis Management Act, 1855, requiring them to make good the whole of the damaged pavement; and the Board's men attended on the 13th, excavated the ground, and found on a 4-inch main a leaky joint which they repaired. A requisition from the Board, dated that day, to reinstate an area of pavement 8 ft. by 6 ft., was received by the City Engineer on the 16th ult. The area of pavement damaged measured about 30 ft. by 9 ft., and on receipt of the above-mentioned requisition the Engineer served notice upon the Board that the measurements stated in the requisition were insufficient. The Board having failed to comply with the first notice, and the pavement having become dangerous, it was fenced and watched, and subsequently repaired by the Council's contractors. The Board had not sent any reply to the Council's notices, except the requisition to reinstate the small portion of pavement actually disturbed by them for the purpose of repairing their pipe. The work the Board executed in Wellington Street for the purpose of repairing the leakage of their pipe was not the taking up of a sufficient area of the damaged portion of the pavement referred to in a notice served on the Board by the Council's Engineer on the 12th of November; and the work so done by the Board was not a taking up of the pavement to the satisfaction of the Council. The Committee said they had approved and ratified the acts done by the Engineer, and had referred the case to the Town Clerk, with instructions to take such action as he might deem necessary with regard to the Board's non-compliance with the notice of Nov. 12, and the recovery of the expenses of making good the pavement.

Ashford (Kent) Gas Supply.—At the last meeting of the Ashford (Kent) Urban District Council, it was decided to make a further reduction in the price of gas, of 2d. per 1000 cubic feet, as from the December quarter. At the same time, acting on the report of the Engineer and Manager (Mr. H. R. Turner), further concessions were determined upon to encourage the demand for gas by allowing the free services of a maintenance man to attend to incandescent burners, providing the consumer pays for all materials used. Cookers will be fixed free; an increase in the number of fittings to slot consumers will be allowed; and these consumers will have the privilege of selecting inverted gas-fittings if preferred.

Suffocation by Gas in Soho.

In the Westminster Coroner's Court, on Monday last week, Mr. Troutbeck held an inquiry concerning the death of Mendel Tasselcourt, aged 44, a tailor, who was found suffocated in a house in St. Anne's Court, Dean Street, Soho, on the previous Saturday morning. His son, Alexis, aged 18, was found unconscious; but he is recovering. Dora Tasselcourt stated that the deceased man was her husband. He slept in a small room with one of his sons, and they retired to rest at 12.30 a.m. on Saturday. Fourpence had been put into the gas-meter at 6.30 p.m. on Friday. At seven o'clock on Saturday morning, witness went to call her husband and son, but was unable to make them hear; and on the door being burst open one was found dead and the other insensible. The room was full of gas. The daughter of the previous witness said the only ventilation to the room was a small hole in the top of the door. Witness burst open the door, and discovered that her father and brother were lying on the floor, as if they had tried to get out after finding themselves partially overcome. The gas was escaping from the only burner in the room. Inspector Renfry informed the Coroner that the so-called room in which the two men slept was little more than a cupboard. Its dimensions were 9 ft. by 6 ft. and 8 ft. 6 in. high. A police-constable who was called to the house said the father had been removed to the landing, and the son, who was on a bed, appeared to be lifeless. He resorted to artificial respiration, and succeeded in bringing the lad round. Dr. Edward Clarkson said the constable had used great discretion in his treatment of the lad, who was suffering from poisoning by coal gas; but sleeping in such a box as the room was, would produce illness without any escaping gas. Dr. Freyberger, who made an autopsy, said death was due to suffocation from poisoning by gas. It was stated that there was no defect in either the gas-meter or the burner. A verdict of "Accidental death" was returned.

Gas Profits at Loughborough.—The statement of accounts of the Loughborough Corporation gas undertaking for the half year ended Sept. 30 shows receipts amounting to £7846, made up as follows: Sale of gas, £5646; residuals, £1323; public lamps, £177; and rent of stoves and slot installation, £700. The expenditure totalled £5945, leaving a balance to be carried to the profit and loss account of £1901. The profit on revenue account is £339 more than for the corresponding period of last year.

New South Wales Coal Strike and the Sydney Gas Supply.—Our readers are aware, from the reports which have appeared in the daily papers, that a strike of coal miners is going on in New South Wales, and it is necessarily imperilling the gas supply. According to a telegram recently received through Reuter's Agency, owing to the strike of the coal lumpers, the Union men will not handle the Sydney Gas Company's coal alongside the wharves; and it is feared that the gas supply will cease at the end of the present week.

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The Cement Industry and the Supply of Coke.

An intimation was given last Friday to the employees of Messrs. Tolhurst and Sons, cement manufacturers, Northfleet, that, owing to a shortage of coke, unless fresh supplies were obtained in a few days, the works would be closed for two or three weeks. Messrs. Tolhurst, whose coke has been supplied by the Gaslight and Coke Company, received a letter from them on Wednesday, stating: "We are faced with a heavy accumulation of craft waiting to load coke at Beckton; and as there is likely to be considerable delay, we shall be glad if you will arrange not to send any more barges into Beckton until we can advise you that the turns will be normal, so as to avoid loss to you through delay, which at present is unavoidable." Messrs. Tolhurst replied: "We have coke to last us about a week, if so long; and unless we can get a supply, our factory will come to a standstill, and all our men will be out of employ." The announcement has caused great anxiety in Northfleet, where there is already much distress.

Quality of Barnet Gas.

At the last meeting of the East Barnet Valley Urban District Council, Mr. Ford moved that a qualified person be appointed to test as often as necessary the gas supplied in the district. As the Council knew, there had been complaints; and to every one a reply was sent suggesting that the Barnet Gas Company should be allowed to fit up a certain kind of burner. Mr. Abbott, the Building Inspector, might be able to make the suggested tests. Mr. Waller, in seconding the motion, said that if it was proved that the gas was deficient in quality, the Company would, no doubt, be prepared to remedy the matter at once. The motion was not brought forward in a spirit of hostility, but of friendliness. Mr. Glass said he had made a number of tests of various systems of lighting, and he believed that, with proper appliances, gas was as good an illuminant as could be obtained. The Company were fully alive to the necessity for supplying good gas; and he was sure the gas in the district was superior to that supplied in other areas. In conclusion, he urged that the matter should be amicably arranged with the Company. The Chairman (Mr. Hasluck) said he had received a letter from Mr. Bancroft, the Company's Engineer and Manager, furnishing the following particulars as to the illuminating power of the gas during the past month: Highest, 17·4 candles; lowest, 16·3 candles; average, 16·7 candles. The Chairman added that the Company were not compelled to supply gas of more than 14-candle power. In the result, the motion was carried, and the Works Committee were instructed to consider the best way of making the tests.

Gas-Stoves Popular at Burton-on-Trent.—The Gas Committee of the Burton-upon-Trent Corporation some time ago decided to fix, free of charge for prepayment consumers, 500 stoves in place of the small grillers previously supplied. The results have been so satisfactory that at the meeting of the Town Council on Wednesday last, it was decided, on the recommendation of the Committee, to purchase 1000 more. The consumption of gas last month was upwards of 2 million cubic feet more than in the corresponding month of last year; and the increase is attributed to the more extended use of gas-stoves.

Scunthorpe and the Gas Supply of Crosby.—A Local Government Board inquiry has been held by Mr. F. J. Willis into an application by the Scunthorpe Urban District Council for powers by Provisional Order to amend their Gas and Water Act, 1899, so as to include the township of Crosby in their area of supply. The only debatable point raised at the inquiry was with regard to an application from Crosby to definitely fix the price of gas. Scunthorpe supply their own consumers at 3s. 4d. per 1000 cubic feet. The Inspector suggested a clause in the Order to the effect that Crosby should pay Scunthorpe 3s. 6½d. per 1000 cubic feet until their consumption rose to 5 millions per annum; and when this amount was reached, they should have it at the same price as Scunthorpe consumers. The parties agreed to this.

The Water Supply of Abercarn.—By fourteen votes to one, the Abercarn Urban District Council have passed a resolution to the effect that they should apply in the next session of Parliament, in conjunction with the Urban District Councils of Abertillery and Risca, or one of them, for a Bill to constitute and incorporate a Water Board and to authorize the Board to construct works for obtaining a supply of water from the Grwyne Fawr and to supply water throughout the urban districts of Abertillery, Abercarn, and Risca, and the portion of the urban district of Mynyddislwyn within the present limits of supply of the Risca Urban Council, and for other purposes; and that the expenses be defrayed in the first place out of the general district rate, and ultimately out of money to be borrowed under the provisions of the Act.

Exmouth Water Bill.—A special meeting of the Exmouth District Council was held last Wednesday to formally sanction the proposed application to Parliament for an Act authorizing the Council to proceed with the extension of the water-works. The Chairman (Mr. W. C. Creedy) proposed the necessary resolution. Mr. Beavis elicited from the Solicitor to the Council that the proposed Bill did not repeal a clause in a former Act which prohibited boring for water in certain places, and said that if the supply from the proposed well at Dotton failed, they could not bore elsewhere, and the whole scheme would be of no use. The Council's hands were tied to this extent, and he liked the present Bill less than the one which was proposed last year. Mr. Harris, the Solicitor, said Parliament would not give the Council or anyone else power to bore for water at unspecified places. The Rev. O. J. Reichel objected that the borrowing powers of the Council were not sufficiently defined in the Bill. By one clause they had unlimited power for borrowing in excess of the £18,000 which was the estimated cost of the scheme. He was also opposed to the proposition to supply places outside the district. If it was necessary to supply a large district with water, it was the business of a Water Company, and not of the Council. Mr. Abell said the supply of places adjacent to the Council's area would not entail any burden on the ratepayers. People taking the water would have to pay the same rate as at Exmouth, and have to bring their pipes to the main. The motion was adopted by 12 votes to 6.

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Praise for the Rotherham Gas-Works Management.

At the eleventh annual tea and concert of the Rotherham Gas-Works Cricket Club, which took place on the 4th inst. in St. George's Hall, Alderman Gummer, J.P., the Chairman of the Gas Committee of the Corporation, who presided, referred in appreciative terms to the management of the gas-works by Mr. J. S. Naylor, the Gas Engineer and Manager. He said that during the last three years the make of gas had increased to the extent of 20 million cubic feet, and the sales by 25 millions; while 12,345 cubic feet of gas had been obtained per ton of coal carbonized, which he believed was the highest record of any gas undertaking in the country. Thanks were due to Mr. Naylor for the able manner in which he had conducted the works, and to the stokers and other employees for their efficient services. The Gas Department was the most important one of the Corporation, and the gas-works had been kept thoroughly up to date; the amount spent on repairs and renewals this year having been £7420. The leakage had been ably tackled by Mr. Naylor. It was very high at the time of his appointment; but it had been reduced by 2 per cent., which meant a saving of 3 million cubic feet of gas per annum. The question had often been asked how it was they could not sell gas as cheaply as Sheffield. But when it was remembered that during the last thirty years close upon £100,000 out of the profits of the gas undertaking had been handed over to the relief of the rates, they would have some idea how it was that gas in Rotherham was dearer than in Sheffield. As the other departments required relief, and as the Gas Department was the only milch cow, they had to find the money. The Borough Auditor (Mr. C. H. Moss, J.P.) said the Chairman, the Manager, and the Chief Clerk (Mr. F. Hyland) were a credit to the Gas Department; and the carbonization record which had been mentioned was extremely creditable to Mr. Naylor and all concerned. Alderman Grundy also spoke approvingly of the management of the gas undertaking.

The Wages Question at the Rochdale Gas-Works.—The Gas and Electricity Committee of the Rochdale Corporation further discussed last Wednesday the application of the labourers at the gas-works for an advance in wages. The previous week (see *ante*, p. 694), the Town Council rejected a recommendation of the Committee that to settle the problem of what wages should be paid to Corporation labourers, a Joint Committee should be appointed representing all departments employing labour. The Committee now decided that in future the wages of labourers at the gas-works should be at the rate of 5½d. per hour, instead of being paid by the day. The decision of the Committee means practically an advance from 24s. to 25s. 6d. a week, inclusive of holiday pay.

The Buenos Ayres Gas Amalgamation.—Our readers are aware that the contract entered into with the Municipality of Buenos Ayres for the fusion with the Primitiva Gas and Electric Lighting Company, Limited, of the River Plate and Buenos Ayres (New) Gas Companies has been ratified; and provisional agreements have been entered into for the acquisition of the whole of the assets of the latter Companies by the former. The necessary meetings for the adoption of these agreements have been convened for next Tuesday. In view of the amalgamation, it is proposed that the Board of the Primitiva Company shall be increased to ten, by the appointment of members of the Boards of the two other Companies concerned; also that their remuneration shall be raised in the first instance to £6200 per annum, to be gradually lowered to £3200 as the number of Directors is reduced to five. In the belief that the fusion of the undertakings will be beneficial to the shareholders of all the Companies, the Board of the Primitiva Company have no hesitation in recommending the shareholders to accept it.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards placed two new issues of capital by order of Directors. The first lots consisted of "C" £10 shares in the Harrow and Stanmore Gas Company ranking for a standard dividend of 7 per cent., subject to the sliding-scale; the last dividend paid on similar shares having been at the rate of £7 7s. per cent. per annum. They fetched from £14 15s. to £15 2s. 6d. each; the average being £15 0s. 3d. The other new issue was 500 £10 new ordinary 5 per cent. maximum shares, and £5000 of 4 per cent. perpetual debenture stock of the Southend Water Company. The dividend on similar shares for the year ended Dec. 31 last was 4¼ per cent.; and those offered on Tuesday fetched £10 2s. 6d. and £10 5s. each—the debenture stock selling at £101 to £104 per £100. On the same occasion, some £10 fully-paid ordinary shares in the Lowestoft Water and Gas Company, ranking for a maximum dividend of 10 per cent. per annum, but carrying 7½ per cent., realized £16 to £16 5s. per share; and some additional £10 shares (7 per cent. maximum dividend, but carrying 5¼ per cent.), £11 10s. each. These shares were sold for a private owner.

Crowborough and Street Lighting.—A parish meeting has been held at Crowborough for the purpose of deciding whether the Lighting and Watching Act should be adopted; but the result was of a negative character, in spite of the eloquent arguments in favour of a public lighting system. A scheme had been proposed under which a 3d. rate would be necessary for three years. At the expiration of this time, however, the lamps would have been paid for; and then there would only be the cost of gas and the maintenance. One gentleman said that at present it was difficult enough to get gas for the houses; and he did not see how, if 82 public lamps were placed in the streets, the Gas Company were going to supply the requisite quantity of gas. Mr. Irwin A. Cook, the Manager of the Gas Company, stated that during the past summer new plant had been laid down at the works, which would enable the Company to supply gas at any pressure necessary; and he could safely say that, if the street-lamps were put up, it would not affect the pressure to any extent whatever. The Chairman (Mr. W. Froy) remarked that the Gas Company had promised to enter into an agreement to supply gas to the Council at 10 per cent. less than the usual rate, which would bring the price to about 4s. per 1000 cubic feet. On the resolution being put to the meeting, 33 only voted for it; and the Chairman announced that, as only about one-third of those present had voted, the matter would fall through.

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A serious gas explosion occurred last Friday morning at St. James's Church, New Brighton. Most of the windows were blown out, and extensive damage was done to the organ and the chancel fittings. A defect in the gas-main under the church is supposed to have been the cause of the explosion.

The Cardiff Technical Schools Committee last Thursday received deputations concerning the proposed formation of a class for gas-fitters. A deputation of operative and master plumbers (of which the respective spokesmen were Mr. Lowe and Mr. Sawyer) objected to the teaching of joint-wiping; and Mr. Langford, for the Gas Company, said that, owing to the changes that had taken place in the utilization of gas for heating and motive purposes, gas-fitters required to know more now than had been previously required of them. After prolonged discussion it was decided to defer the matter until the Committee had obtained the advice of the City and Guilds of London Institute as to what could properly be included in a syllabus for plumbers, and what in a syllabus for gas-fitters.

At the annual general meeting of Messrs. James Milne and Son, Limited, on Thursday, the Directors will report that the net result of the working in the year ended Sept. 30 last, including the balance brought forward, is a loss of £4773. It is explained that, owing to the extreme depression in trade, it was necessary to work at very low prices in order to keep the connection together; and this, coupled with an inevitable reduction of turnover, rendered it impossible to earn any profits. The Directors state that the works and branches are all fully equipped, and able to take advantage of any improvement in trade that may occur.

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GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 731.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 14	10	Alliance & Dublin 10 p.c.	17—18	..	5 11 1
298,955	10	,,	7	Do. 7 p.c.	12½—13	..	5 7 8
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	100—102	..	3 18 5
200,000	5	Oct. 28	6¼	Bombay, Ltd.	5⅞—6	..	5 8 4
40,000	5	,,	6¼	Do. New, £4 paid	4⅞—4¾	..	5 9 1
50,000	10	Aug. 26	15	Bourne- mouth Gas and Water	10 p.c.	28—28½	.. 5 5 3
					B 7 p.c.	16½—16¾	.. 4 3 7
					Pref. 6 p.c.	15½—15¾	.. 3 16 2
311,810	10	,,	7	Brentford Consolidated	253—256	..	4 17 8
75,000	10	,,	6	Do. New	190—192	..	4 19 0
380,000	Stk.	Aug. 12	12½	Do. 5 p.c. Pref.	120—122	..	4 2 0
300,000	,,	,,	9½	Do. 4 p.c. Deb.	100—102	..	3 18 5
50,000	,,	,,	5	Brighton & Hove Orig.	208—213	..	5 3 3
206,250	,,	June 11	4	Do. A Ord. Stk.	150—152	..	5 5 3
220,000	Stk.	Sep. 10	11	British	42¾—43¾	..	4 11 11
246,320	,,	,,	8	Bromley, A 5 p.c.	118—120	..	5 0 0
460,000	20	Oct. 14	10	Do. B 3½ p.c.	88—90	..	5 0 0
109,000	Stk.	Aug. 26	6	Do. C 5 p.c.	106—108	..	5 1 10
165,700	,,	,,	4¼	Do. 3½ p.c. Deb.	88—90	..	3 17 9
82,278	,,	,,	5⅜	Buenos Ayres (New) Ltd.	13¾—14	..	5 0 0
55,000	,,	June 25	3½	Do. 4 p.c. Deb.	96—98	..	4 1 8
500,000	10	Oct. 14	7	Cape Town & Dis., Ltd.	3—4	+½	—
250,000	Stk.	June 25	4	Do. 4½ p.c. Pref.	5⅞—5¾	..	—
100,000	10	—	—	Do. 6 p.c. 1st Mort.	47⅞—48¼	..	6 3 9
100,000	10	—	—	Do. 4½ p.c. Deb. Stk.	82—84	..	5 7 2
50,000	50	Nov. 2	6	Chester 5 p.c. Ord.	108¼—110½	..	4 10 6
100,000	Stk.	June 25	4½	Commercial 4 p.c. Stk.	109—111	..	4 13 8
157,150	Stk.	Aug. 12	5	Do. 3½ p.c. do.	103—105	..	4 15 3
1,493,280	Stk.	Aug. 26	5⅛	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
560,000	,,	,,	5	Continental Union, Ltd.	95—97*	+½	5 3 1
475,000	,,	June 11	3	Do. 7 p.c. Pref.	137—139*	+.½	5 0 9
800 000	Stk.	Dec. 10	5	Derby Con. Stk.	121—123	..	4 1 4
200,000	,,	,,	7	Do. Deb. Stk.	103—105	..	3 16 2
492,270	Stk.	—	5	East Hull 5 p.c. Ord.	97—99	..	5 1 0
55,000	,,	—	4	European, Ltd.	24½—25	+¼	4 16 0
148,995	,,	Oct. 2	5	Do. £7 10s. paid.	18—19	..	4 14 9
486,090	10	July 14	12	Gas light and Coke	4 p.c. Ord.	102½—103½	.. 4 10 1
354,060	10	,,	12		3½ p.c. max.	87—89	.. 3 18 8
15,141,545	Stk.	Aug. 12	4⅝		4 p.c. Con. Pref.	103—105	.. 3 16 2
2,600,000	,,	,,	3⅛		3 p.c. Con. Deb.	82—84	.. 3 11 5
3,799,735	,,	,,	4	Hastings & St. L. 3½ p.c.		92—94	.. 5 6 4
4,193,975	,,	June 11	3	Do. do. 5 p.c.		117—119	.. 5 9 3
258,740	Stk.	Sep. 10	5	Hongkong & China, Ltd.		17½—18	.. 6 2 3
82,500	,,	,,	6½	Ilford A and C		144—146	.. 4 9 0
70,000	10	Sep. 29	11	Do. B		108—110	.. 4 10 11
131,000	Stk.	Sep. 10	6½	Do. 4 p.c. Deb.		102—104	.. 3 16 11
65,782	,,	,,	5	Imperial Continental		175—177	.. 4 10 5
65,500	,,	June 25	4	Do. 3½ p.c. Deb. Red.		94—96	.. 3 12 11
4,940,000	Stk.	Nov. 11	8	Lea Bridge Ord. 5 p.c.		119—121	.. 4 19 2
1,235,000	Stk.	Aug. 12	3⅛	Liverpool United A.		223—225	.. 4 8 11
195,242	Stk.	Aug. 26	6	Do. B.		166—168	.. 4 3 4
561,000	Stk.	,,	10	Do. Deb. Stk.		104—106	.. 3 15 6
718,100	,,	,,	7	Malta & Mediterranean.		4⅜—5	.. 6 0 0
306,083	,,	June 25	4	Met. of 5 p.c. Deb.		99—102	.. 4 18 0
75,000	5	Nov. 26	6	Melbourne 4½ p.c. Deb.		100—102	.. 4 8 3
560,000	100	Oct. 1	5	Monte Video, Ltd.		12½—13	.. 5 7 8
250,000	100	,,	4½	Newc'tle & G'tesh'd Con		106—108	.. 4 3 4
541,920	20	Nov. 11	3⅛	Do. 3½ p.c. Deb.		93—94¼	.. 3 14 6
1,775,892	Stk.	July 29	4½	North Middlesex 7 p.c.		13—13⅜	.. 5 3 8
518,795	Stk.	June 25	3½	Oriental, Ltd.		137—139	.. 5 15 1
55,940	10	Aug. 26	7	Ottoman, Ltd.		6⅜—6⅝	.. 6 5 6
300,000	Stk.	Nov. 26	8	Portsea Island A.		137—139	.. 4 19 0
60,000	5	Sep. 10	8	Do. B.		129—131	.. 4 19 3
31,800	33	Aug. 26	13	Do. C.		120—123	.. 4 17 7
60,000	50	,,	13	Do. D and E.		101—103	.. 4 17 1
100,000	50	,,	12	Primitiva Ord.		6¼—7⅛	.. 4 18 5
114,800	50	,,	10	Do. 5 p.c. Pref.		5⅜—1⅝	.. 4 13 0
398,490	5	Oct. 28	7	Do. 4 p.c. Deb.		94—96	.. 4 3 4
796,980	5	July 29	5	River Plate Ord.		16½—17	+½ 4 14 2
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.		97—99	.. 4 0 10
1,000,000	10	Oct. 14	8	San Paulo, Ltd.		14⅜—15	.. 5 6 8
312,650	Stk.	June 25	4	Do. 6 p.c. Pref.		11⅜—12¼	.. 4 18 0
250,000	10	Sep. 29	8	Do. 5 p.c. Deb.		51—52	.. 4 16 2
62,500	10	,,	6	Sheffield A		230—232	.. 4 6 2
125,000	50	July 1	5	Do. B		230—232	.. 4 6 2
135,000	Stk.	Sep. 10	10	Do. C		230—232	.. 4 6 2
209,984	,,	,,	10	South African		12⅛—12⅝	.. 7 16 11
523,500	,,	,,	10	South Met., 4 p.c. Ord.		119—121	.. 4 8 1
70,000	10	Oct. 14	10	Do. 3 p.c. Deb.		81—83	.. 3 12 3
6,429,895	Stk.	Aug. 12	5⅓	South Shields Con. Stk.		160—162	+1 4 18 9
1,895,445	,,	July 14	3	S'th Suburb'n Ord. 5 p.c.		119—121	.. 4 10 11
209,823	Stk.	Aug. 26	8	Do. 5 p.c. Pref.		120—122	.. 4 2 0
605,000	Stk.	Aug. 12	5⅓	Do. 5 p.c. Deb. Stk.		122—124	.. 4 0 8
60,000	,,	,,	5	Southampton Ord.		109—111	.. 4 10 1
117,058	,,	July 14	5	Tottenham and Edmonton	A 5 p.c.	133—135	.. 5 1 9
502,310	Stk.	Nov. 11	5		B 3½ p.c.	111—113	.. 4 15 3
120,000	Stk.	Aug. 12	6⅔		4 p.c. Deb.	100—102	.. 3 18 5
453,940	,,	,,	5⅝	Tuscan, Ltd.		9—9½	.. 8 8 6
149,470	,,	June 25	4	Do. 5 p.c. Deb. Red.		101—102	.. 4 18 0
182,380	10	June 11	8	Tynemouth, 5 p.c. max.		110—112	.. 4 9 3
149,900	10	July 1	5	Wands- worth	B 3½ p.c.	139—141	.. 4 14 0
236,476	Stk.	Aug. 14	5		3 p.c. Deb. Stk.	73—75	.. 4 0 0
255,636	Stk.	Aug. 26	6⅔	West Ham 5 p.c. Ord.		123—125	.. 4 6 0
79,416	,,	June 25	3	Do. 5 p.c. Pref.		127—129	+ 2 3 17 6
895,872	,,	Aug. 12	5⅝	Do. 4 p.c. Deb Stk.		108—110	.. 3 12 9
210,000	,,	,,	5				
253,300	,,	June 25	4				

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By order,
J. H. Hallsworth,
Town Clerk.

Oldham, Dec. 2, 1909.

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TENDERS are invited for the Tar produced at the above Works for a period of Six or Twelve Months from the 1st of January, 1910, delivered into Contractor's Tanks at the Bridgewater Colliery Siding, Wharton Hall, on the Pendleton and Hindley Branch of the Lancashire and Yorkshire Railway; or at the Brackley Siding, Little Hulton Mineral Branch, of the London and North-Western Railway.
The estimated quantity is about 2600 Tons per Annum.
Tenders, endorsed "Tender for Tar," to be addressed to Mr. Thomas M. Brown, Bridgewater Coal Offices, 4, Chapel Walks, Manchester, not later than the 21st of December.
Manchester, Dec. 7, 1909.

TO IRON FOUNDERS AND IRON ROOF CONTRACTORS.

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THE Directors of the Sheffield United Gaslight Company invite TENDERS for the Supply and Erection of a STEEL ROOF, 304 ft. long by 105 ft. 6 in. wide, in two Spans of 71 ft. and 33 ft 6 in., forming the roof over their No. 3 Retort-House at Neepsend Works.

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The Directors do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Tender for Roof," or "Tender for Mouthpieces," must be delivered by post to Mr. Hanbury Thomas, Managing-Director, not later than the first post on Tuesday, the 21st day of December.

Wm. Hamby,
Secretary.

Commercial Street, Sheffield,
Dec. 1, 1909.

CITY OF CHICHESTER GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the FOUR PER CENT. PERPETUAL DEBENTURE STOCK of this Company WILL BE CLOSED from the 18th of December to the 31st of December, 1909, both inclusive.

By order.
Victor V. Vick,
Secretary.

Offices: Stockbridge Road,
Chichester, Dec. 9, 1909.

BARNET DISTRICT GAS AND WATER COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK ONLY, WILL BE CLOSED on the 24th of December, 1909, and RE-OPENED on the 1st of January, 1910.

By order of the Board,
Ernest W. Drew,
Secretary.

6 & 7, Queen Street,
London, E.C., December, 1909.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK ONLY, WILL BE CLOSED on the 17th inst., and RE-OPENED on Jan. 1, 1910.

By order of the Board,
William E. Roberts,
Secretary.

63, Chancery Lane, W.C.,
Dec. 14, 1909.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
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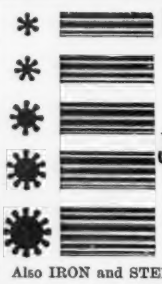

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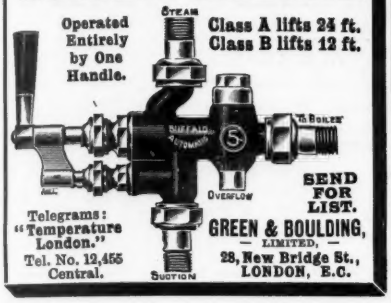

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Sperm Value 878·85 lbs. per Ton.
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PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
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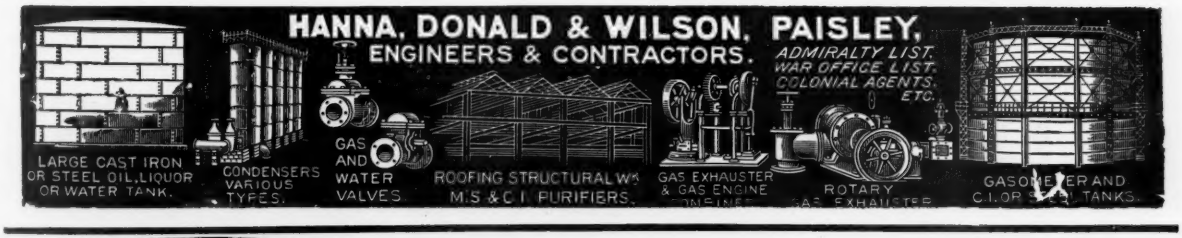
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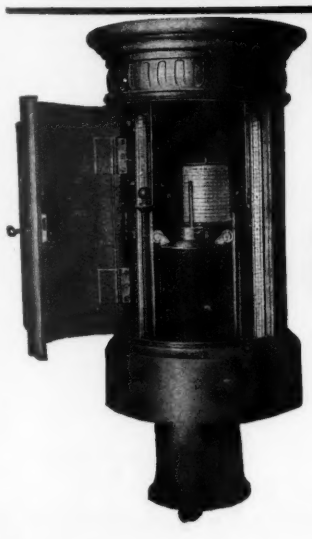

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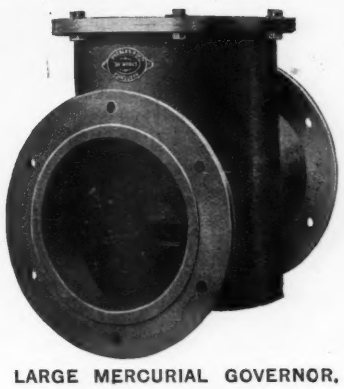
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SPECIAL NOTICE.
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Workmanship and Materials of the Highest Quality.

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AS FITTED TO THE LARGE SPIRAL HOLDER,

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Particulars and Prices on Application. Apparatus Promptly Fitted by Experienced Workmen.

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Important Improvements.

BURNERS.

1. **20-Candle Power more light** without increase in the consumption of gas.
2. **Patent Gas Adjuster;** cannot get out of order.
3. **Automatic Gas Regulator,** ensures a constant and unvarying pressure of 35 mm., guarantees a steady light, at the same time obviating waste of gas and blackening of the burner.
4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
6. The brass casing is heatproof, and, if occasionally cleaned with warm water, will not become discoloured.

LAMPS.

From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

THE GLENBOIG UNION FIRE-CLAY CO., LTD.

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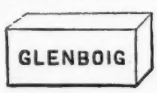
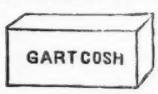
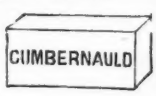
Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS.



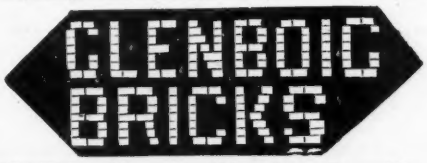




The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.



Works: GLENBOIG, LANARKSHIRE.
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56 Prize Medals and Diplomas of Honour.
Highest Award wherever exhibited.

The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analysis where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, Leadenhall Street,
London, E.C., September 21st, 1909.

Dear Sirs,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

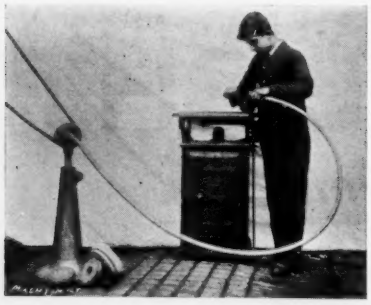
Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70 %
" " 1050° C.	4·76 %
" " Total	8·46 %
Volume shrinkage at 100° C.	10·7 %
" " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. to 3362° F.

(SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.



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GAS STOVE RENEWAL PLANT.

SAVE YOUR COOKERS.

Make them into **NEW ONES** with the

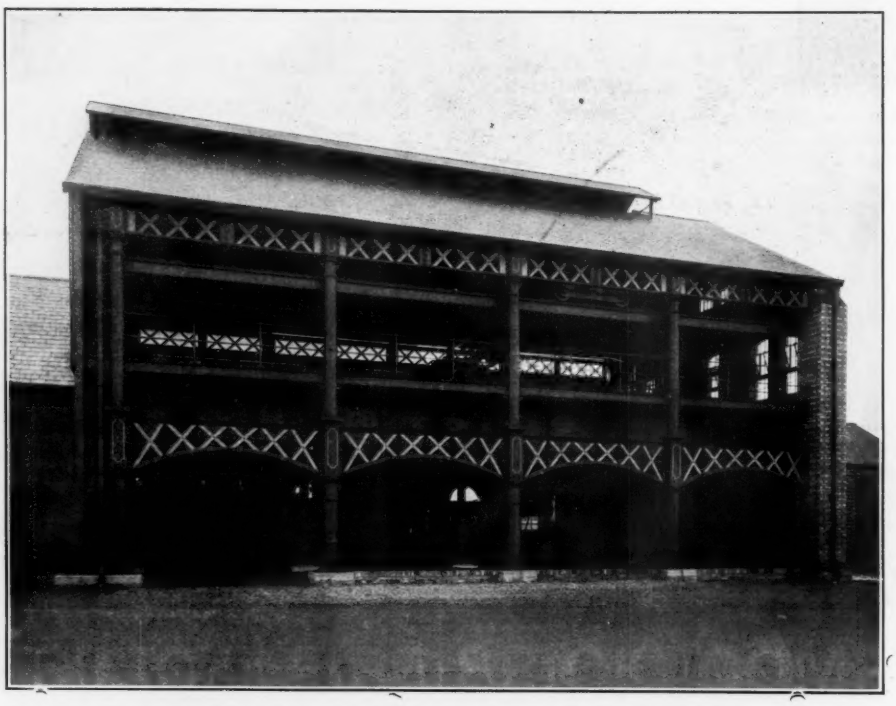
Bambridge Patent Flexible Shaft Co.'s Outfits.

No Experienced Labour Required.

After the Grease is removed, Stoves can be Cleaned and Polished *equal to New*. With a saving of at least **75** per cent. of the usual Cost.

BAMBRIDGE PATENT FLEXIBLE SHAFT COMPANY, LTD.,

KETTERING, ENGLAND.



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Purifiers 30 ft. by 25 ft. Milbourne's Patent { **Valves. Cover Fasteners. Discharge Shoots.**

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RADIATE MORE HEAT

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SILCO BRICKS prevent all settling of setting.

SILICA BRICKS for Combustion Chambers, any shape.

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COAL CONVEYING PLANTS
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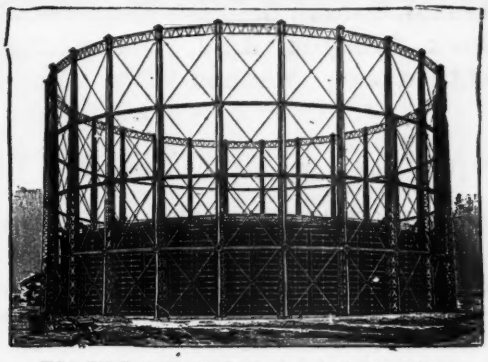

Triple Lift Gasholder, 212 ft. 6 in. diameter by 45 feet Lifts, erected at Garston, Liverpool.

Manufacturers and Erectors of
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GAS PLANTS.
STEEL PIPES.
STEEL TANKS.
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Aggregate capacity of Plant supplied
227,800,000 cubic feet daily.

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SIMPLE AND INEXPENSIVE.

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INCREASED YIELD OF GAS and REDUCTION OF FUEL CONSUMPTION.

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to

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Gas Engineers,
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FINSBURY, E.C.,
LONDON.

Also for name of Works where you can see Machines in operation.

COAL TAR PRODUCTS.

Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Dark Cresylic Acid, Granulated (Crude) and Sublimed Naphthalene, Anthracene, Refined Tar and Pitch. Sulphate of Ammonia up to 20·75 per cent. Nitrogen.

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY,**

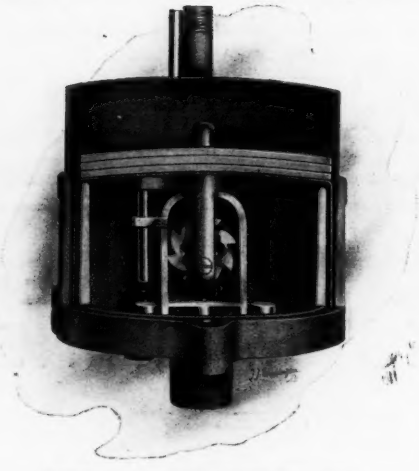
Works: ORDNANCE WHARF, EAST GREENWICH, LONDON, S.E.

709, OLD KENT ROAD, LONDON, S.E.

Telegraphic Address: "METROGAS, LONDON."

The "A. & M." Patent Automatic Gas Apparatus for Street Lighting.

Small. Efficient.
Simple. Cheap.



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CONTROLLED FROM THE GAS-WORKS.

Saves Labour, Gas, Mantles, and Glasses.

Can be brought into action at any hour.

Requires no Winding.

Can Extinguish Different Lights at Different Times as required.

Nothing but Metal in it. No Leather, no Rubber, no Glass.

Has Stood the Test of Years.

Is "All British." Nothing Made Abroad.

ALDER & MACKAY,

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ESTABLISHED 1850.

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MOBBERLEY & PERRY, STOURBRIDGE, LIMITED,

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is a

GUARANTEE OF BEST STOURBRIDGE QUALITY.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

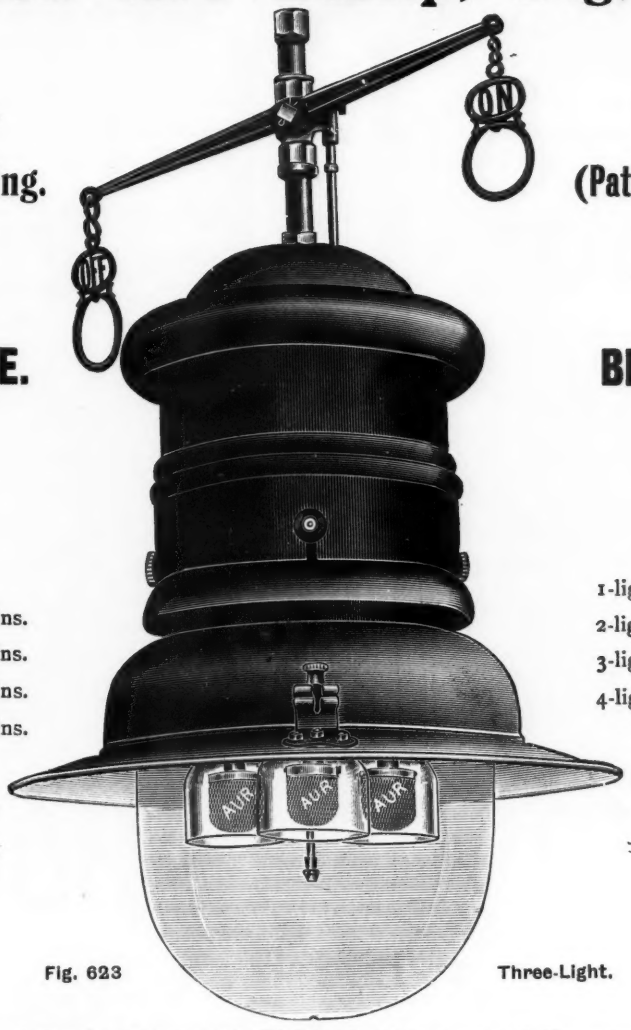

Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.
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Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

CONTINUOUS CARBONIZATION

IN

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GLOVER-WEST PATENTS.

Description and Particulars of Tests will be forwarded on request.

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COST OF LABOUR

REDUCED TO

$2\frac{3}{4}$d. PER TON OF COAL CARBONIZED.

See "JOURNAL OF GAS LIGHTING," Nov. 2, 1909.

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MILES PLATTING, MANCHESTER.

Imitation is the sincerest Form of Flattery.

Tubes of other Origin are often Sold as

MANNESMANN TUBES,

But none are Genuine if they do not bear our Trade Mark as per above facsimile.

THE
BRITISH MANNESMANN TUBE CO., LTD.,
Salisbury House,
LONDON WALL, LONDON, E.C.

Makers of
WELDLESS STEEL SPIGOT and FAUCET, SCREWED and SOCKETTED, FLANGED, &c., TUBES, TUBULAR LAMP POSTS, DRUMS, &c.

CLEANING COOKERS AND LANTERN REFLECTORS

Undoubtedly the Finest and Best Preparation on the Market for **quickly** removing Burnt Grease from the Enamelled Lining of Cookers and Cleaning Lantern Reflectors is

Clarks "GASCOLITE."

(Registered Trade Mark.)

Can either be applied with a Brush, allowed to stand, Cold, for a few hours, or with Heat for about Half-an-Hour, when Liners and Reflectors can be washed off with Hot or Cold Water and will appear as **new,** or, **put into Tanks** with **Boiling Water,** when Liners and Reflectors will be cleaned in about 20 Minutes.

In cases where a **steam pipe** is connected to bottom of tank, stoves or liners can be **perfectly cleaned** in 5 to 10 minutes.

This Result can only be obtained at **lightning speed** by using **"Gascolite."**

Now being used successfully by Gas Companies throughout the United Kingdom and Abroad.

For Trade Prices apply—

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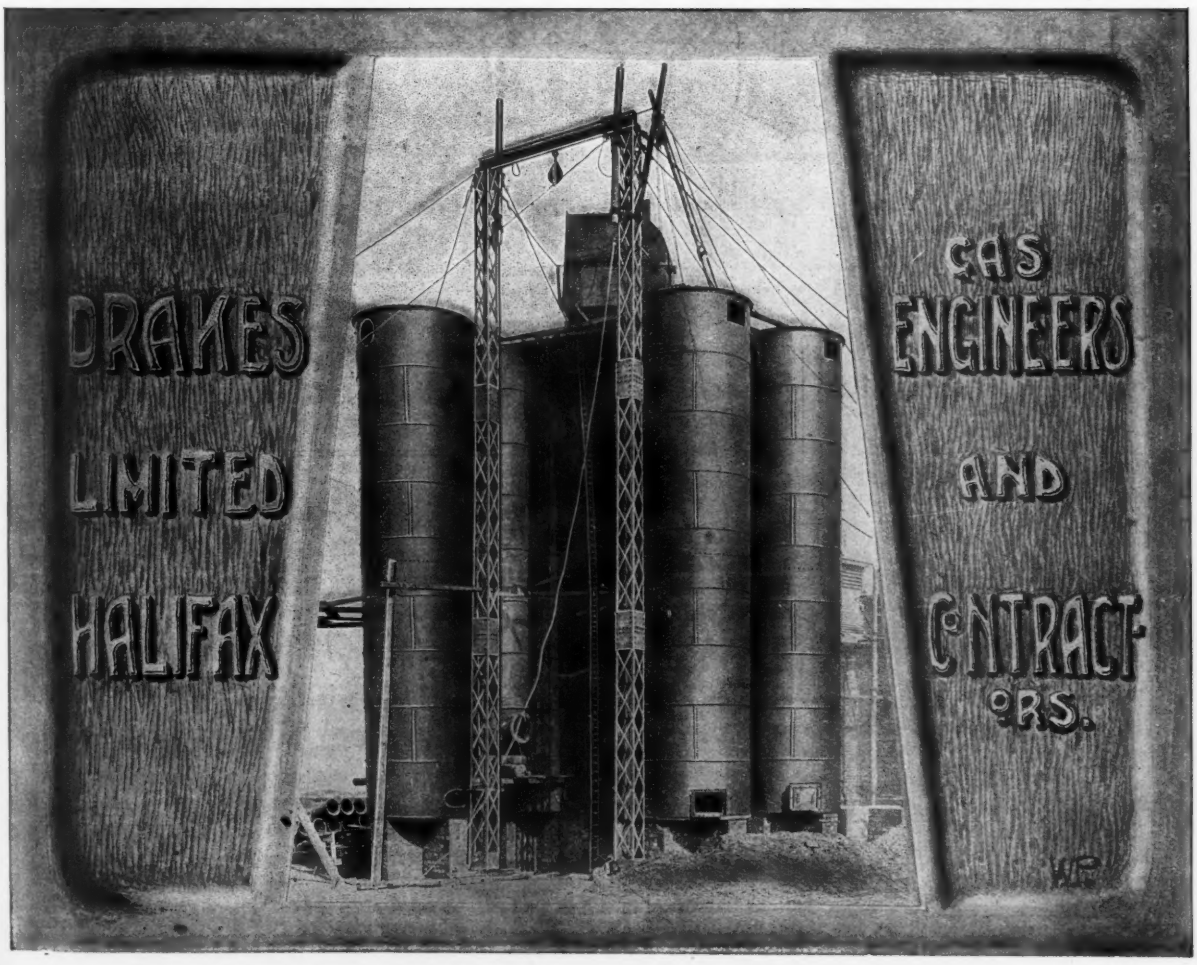
LEAD & COLOUR WORKS CO.
Gas Company Specialists, **READING.**
Established 1832.



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PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

Specially adapted for High Pressures.

FITTED WITH SIX COLUMNS and GIRDERS. WEIGHTS or WATER PRESSURE.

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